THE JOURNAL OF GAS LIGHTING
WATER SUPPLY & SANITARY IMPROVEMENT

VOL. XCI. No. 2202.] LONDON, JULY 25, 1905. [57TH YEAR. PRICE 6d.

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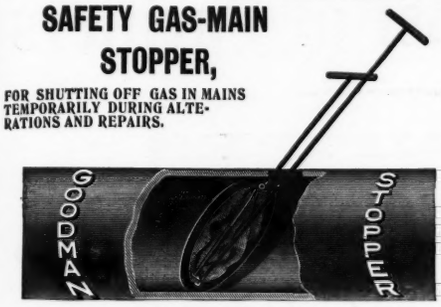

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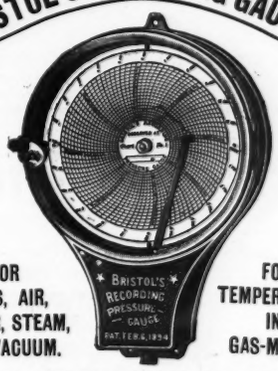

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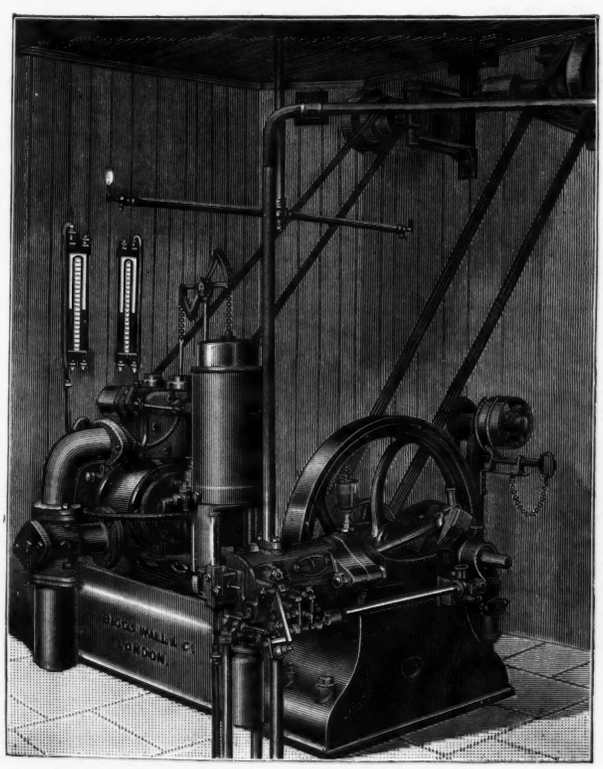

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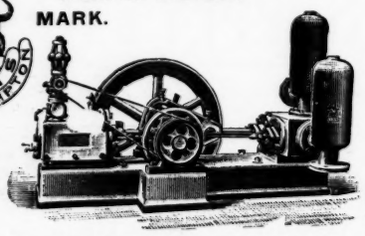

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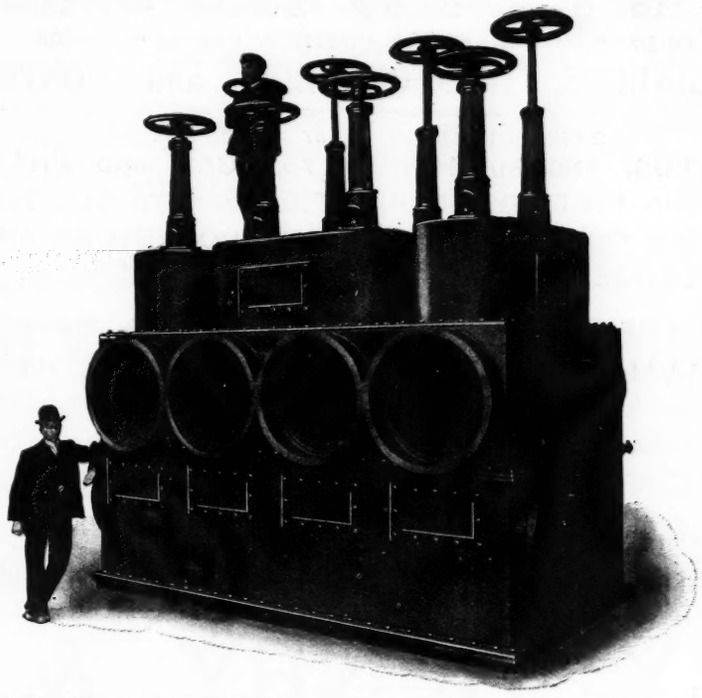

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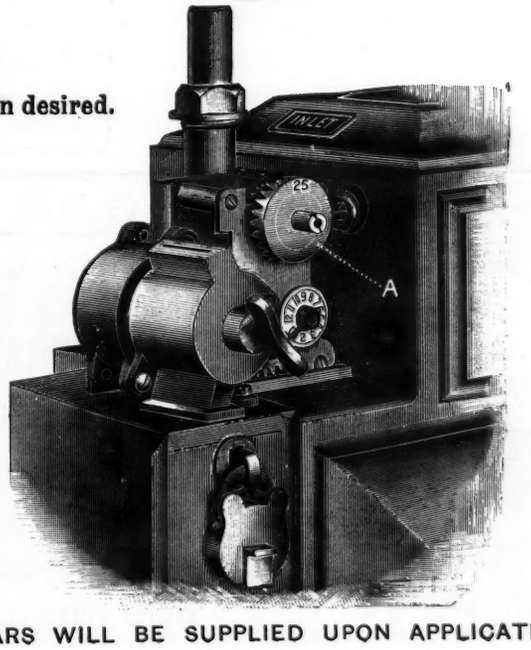

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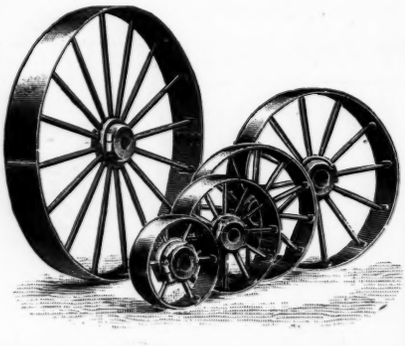

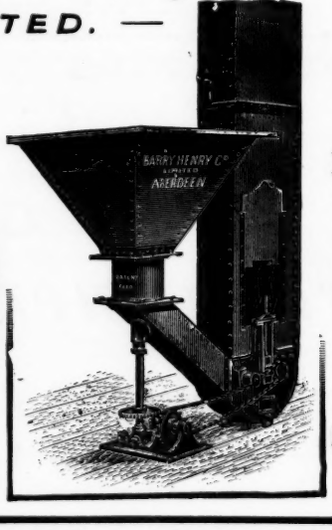

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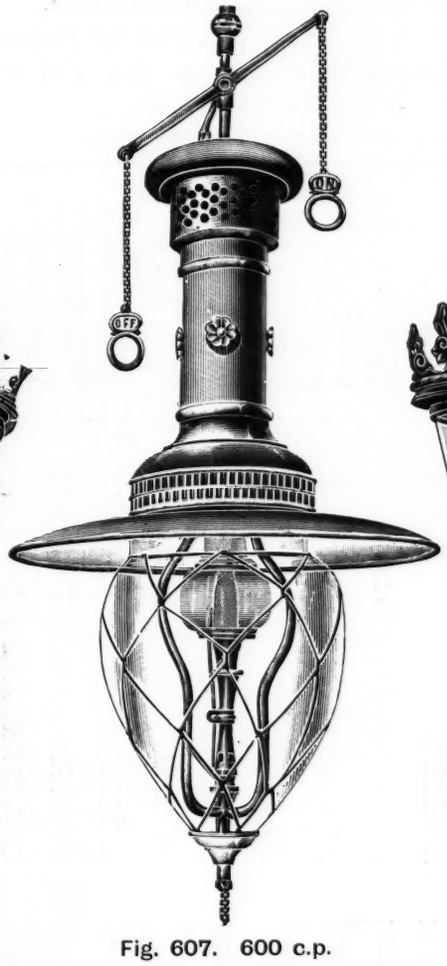

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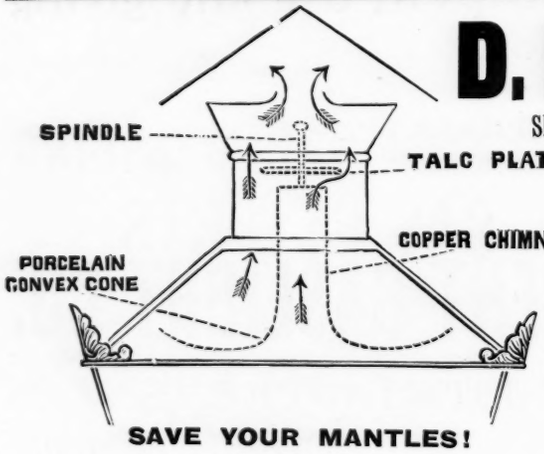

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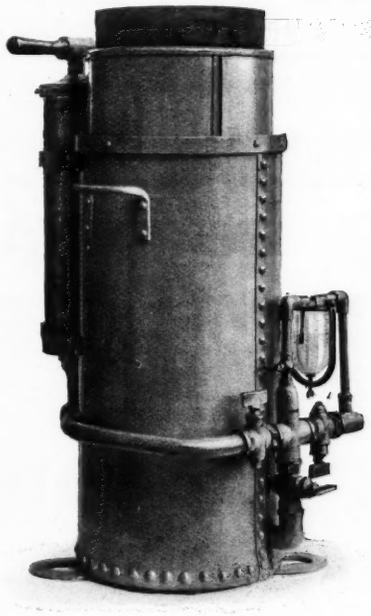

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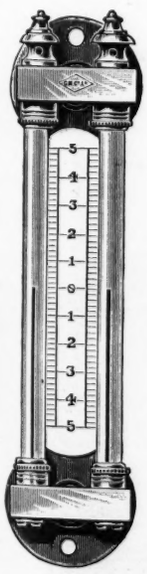

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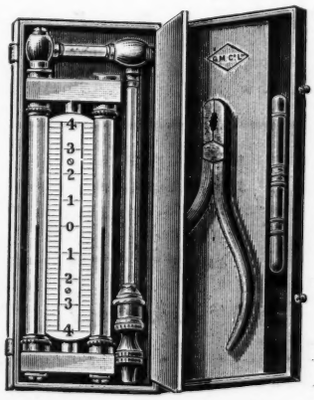

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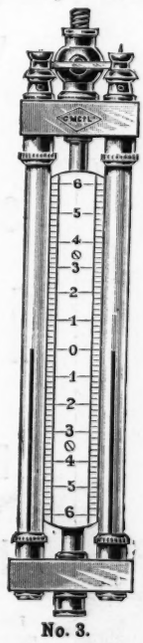

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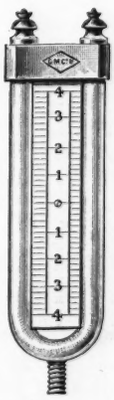

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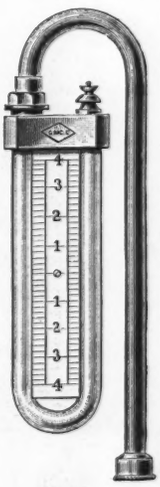

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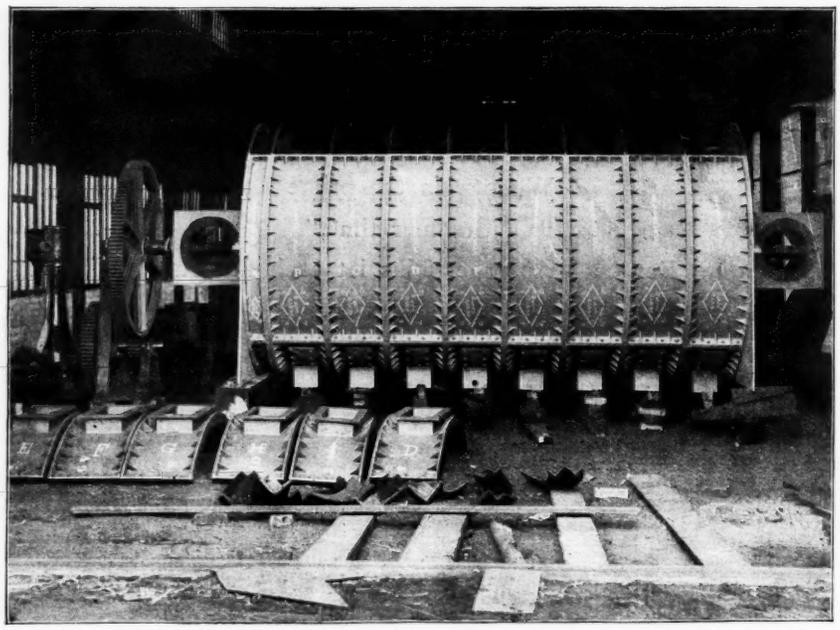

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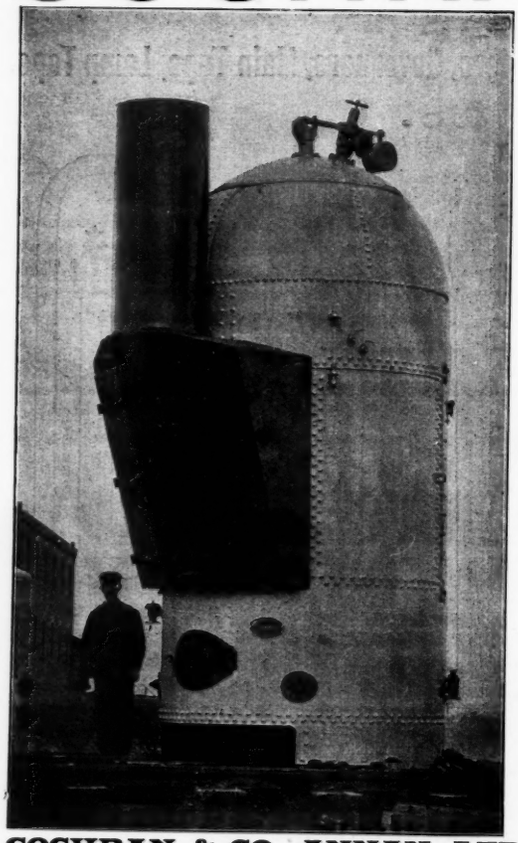

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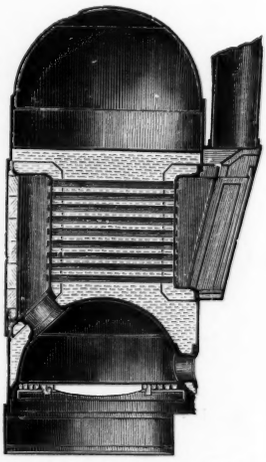

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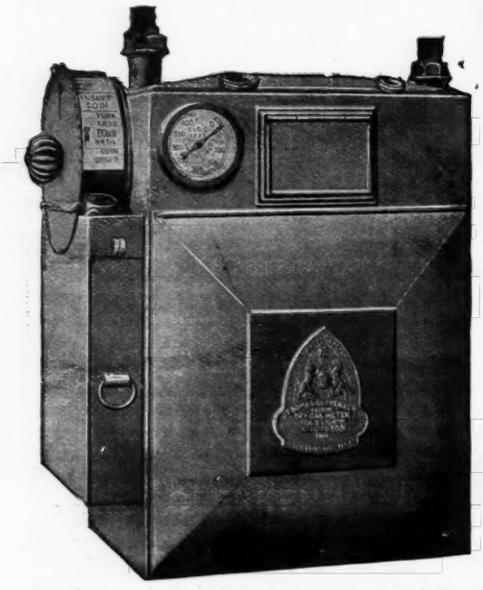

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VOL. XCI., No. 2202.—TUESDAY, JULY 25, 1905.

EDITORIAL NOTES—GAS, &c.

The Problem of London Traffic.

THE first thing that will strike most people on reading the summaries that have been published of the initial volume of the eight that will place on record the work of the Royal Commission on London Traffic, is that the Commissioners are proposing to create an ideal condition of things out of material that does not possess the necessary quality of plasticity, and at a cost that, if Crœsus were with us, would make even him stand aghast. Perhaps it is right for the Commissioners, in fulfilment of their duty, to tell us exactly what is required to make London a mundane paradise; but plain men will wish that the Commissioners had evolved something which is a little more practical. It is recognized that the chaos of authority that has through many decades represented the best forms of government for the Metropolis that the Imperial Government could devise, has brought about the present confusion both above and below ground in London; and the ratepayers and private enterprise have been terrible sufferers in consequence. The cost of what has been done remains; the cost of undoing much of it, or remedying it on the suggested scale, is to put the ratepayers and those who use our large public systems to no end of additional expense, the greatest proportion of which will in all probability have to be largely borne by the present generation of patient ratepayers and gas consumers, while posterity will be the reapers of the benefit.

In this report, an outline of the contents of which is given elsewhere, we have but little direct concern; but indirectly it involves considerations of immense importance to the interests to which many readers of the "JOURNAL" are attached in this great Metropolis. The volume deals with the question of locomotion and transport in London; but betterment in this respect embraces such vast schemes of new avenues and widening of existing thoroughfares, or burrowings beneath those thoroughfares, that there can be no one resident or carrying on business within the Administrative County of London who will not be in some way financially affected. Yet the present proposals only aim at the transport and diffusion of the great aggregation of humanity living and passing to and fro within London; and, therefore, it is a very great pleasure to reflect that this report is only recommendatory. The Commissioners themselves propose that a small expert Board should be constituted for the purpose of dealing with, and having general control over, measures concerning locomotion and transport. It is contemplated that the members of the Board should be selected only on account of their competence and ability, that they should be elected for office covering long periods, and that they should be remunerated for their services. Such specially qualified Boards are what have been required for legislation not only in connection with London traffic but for many specialized public services for long past, in place of the present system of ordaining things by inept or incompetent departments or parliamentary committees, and frequently just as party or personal influence may dictate. Even while this Royal Traffic Commission were considering their report, Parliament gave their consent to further tramways in London; and they seem disposed to now grant gigantic power to electricity suppliers to disturb the streets of London and present occupiers of the subsoil in more senses than one. And this is all being done by men in Parliament who have no more notion of what are the requirements than the workmen who will in consequence be eventually engaged in causing the upheaval of the streets. There is no doubt that there has been a great deal of oversight, and little foresight, in past plans for the development of London; but after the appointment of the Royal Commission, London would most certainly not have been any the worse off if there had been a little delay before making a complex condition still more so.

About the suggested Board, however, it is proposed that the members should be competent, and that they should be paid. The difficulty will be to get competent and impartial men with practical experience to leave their professional work for such an office, unless they are well remunerated for the loss they would incur, just as it has been difficult to comply with the requirements as to the constitution of the Metropolitan Gas Referees. London must make it worth the while of fit and proper persons to undertake this work, if the proposal of the Commission is favourably entertained by Parliament, or such a Board will prove a failure.

The report, among other things, recommends great extensions of the tramway systems, and the further development of street railways, preferably by means of shallow subways. The Commissioners rather favour private enterprise undertaking this work; but if private enterprise will not speculate, then local authorities should be empowered to give assistance by remission of rates or by direct contribution. They also suggest, but have little hope of consummation, two great main avenues extending from west to east and from north to south, at a probable minimum cost of £24,000,000, as well as road widenings to an extent which will stagger the local authorities and their constituents.

While this report appears to be constructed of much that is visionary, we are hoping that the one presented to the Commissioners by the Advisory Board will deal with the interests of the existing occupants of the subsoil of the thoroughfares of London not in a general but in a practical way, and show how they would be affected if the projects before us are entertained. The surface tramways cause quite sufficient disturbance of property lying underground; but the shallow railways suggested would cause a terrible dislocation of distributing systems, and enormous expense, which would fall upon the hapless consumers, whether of gas, water, or electricity. Crowded surfaces, of course, mean crowded subsoil; and in the more congested parts of London the gas and water supply systems are subjected nowadays for their own purposes to very little disturbance. Certainly so far as they are concerned there is no occasion for removal, or for housing in subways where these are constructed. If such disturbance takes place, if there is to be any compulsory transference to subways, the whole expense should assuredly fall as part of the cost of the scheme, and should not, though it might be voted a public improvement, fall upon any single section of the ratepayers as represented by (say) the gas or electricity consumers. Nor, in view of the fact that, in the most congested parts, gas supply is a thing that is settled and causes little nuisance in the way of openings of roads and so forth for the making of connections, does it seem an equitable thing that the exigencies of present-day traffic in our streets should compel from the Companies the burden of payment for accommodation in subways. As ordinary ratepayers, for any general improvement schemes that are an improvement, gas companies are willing to pay their share—and that a large one; but to compel them to contribute in any form more than that would be a double tax on the consumers and a retarding influence on their business. The Commissioners have little to say on the financial question. But there is an idea that the coal and wine dues might be reimposed; and it is believed that they would now yield considerably more than £500,000. Industry is taxed to an overwhelming extent now; and any serious proposal to put upon it this additional burden will be met with most vigorous opposition. The coal-using industries of London never liked the dues; and they and their customers had to bear them. That the coal owners were the only ones who suffered, is a tale that must only be told to those who are not business men. There can be no question that the Commissioners have gone to work in a very thorough spirit; but their report will rather create doubt as to anything of a really beneficial character emanating from their labours.

Connection of Senior and Junior Associations.

In the article on "Life among the Juniors," in last week's issue, we spoke of the connecting-link that the Midland Senior and Junior Gas Associations are going to maintain. We wish that a like junction existed between the other similar organizations; for we believe the time is approaching when every Senior District Association will find in its area one representing their juniors, save perhaps in the one or two instances where distance from a suitable centre is an obstacle. The North British Association have in their area the two sections of the Scottish Juniors; the Manchester Institution, the Manchester District and the Yorkshire District Juniors; the Midland Association, the junior organization to which they have just given birth; and the Southern Association, the London and Southern District Juniors. No one can look hopefully on such junior organizations being successfully floated for Wales or Ireland; but in the North of England and Eastern Counties, the subject ought to be worth inquiry. In the matter of organization, a unique position, as we pointed out last week, has been established by the gas-engineering profession among the engineering sections; and just as the District Associations are united to the Institution of Gas Engineers, so we should like to see the junior organizations affiliated to the former. And unquestionably the day will come when the value of such Associations will, it is believed, be seen perhaps with even more clearness than now.

Consider this. These Junior Associations have for their objects improvement in technical affairs and the cultivation of those qualities which make of juniors constant students and investigators in their individual life's work. But in a secondary sense, these junior organizations are recruiting and preparatory grounds for the senior organizations. The members of the junior organizations, when position qualifies them for membership of the senior organizations, will step from one to the other fully accoutred for the work, and not as raw hands who require, so to speak, a novitiate period before they are capable of useful work in the Association. In the preparation of papers, in debate, and in the management of such professional institutions, the juniors will supply many trained men; and the junior organizations for their part are prepared to do the admittedly rougher work of preparation. We have asked for a free-hearted encouragement for these Junior Associations; and when one comes to ponder over the matter, it is seen that the senior organizations forsooth owe something to the juniors, and should court their allegiance by every possible means. There must be no interference with management; but a link by representation on the Committee, and assistance direct from the seniors (after the manner of the Midland compact), would achieve such an end. A lecture or a paper by an engineer deputed by the Senior Association for the purpose (say) once or twice during a session would be helpful and inspiriting; but, of course, the selection of an engineer qualified for the purpose would have to be made with care.

This remark reminds us of an address delivered by Sir (then Dr.) Alex. B. W. Kennedy before University College towards the end of June; and certainly no one can speak with greater authority on the academic side of technical training than Sir Alexander. It was thirty years since that he gave an opening address to the Faculties of Arts, Laws, and Science of University College in the very same room; and he was then, so far as is remembered, the youngest Professor in the college. Now he is the senior Emeritus Professor so far as the Faculty of Science is concerned, and nearly the oldest ex-member of Senate still connected with the college. But in the address of which we are reminded, Sir Alexander was touching on this subject of lectures and papers in connection with engineering colleges; and he pointed out that, though a senior engineer may have large experience, and have carried out a great deal of work, this very fact may have put him out of touch with the student juniors, and therefore he may be the most unsatisfactory of teachers. The difficulties of the students may have long since ceased to be difficulties to him; and he may, in fact, have forgotten their very existence. Having, too, been for so long dissociated from professional training, he may really know too much to be able to lecture about anything that would be of real advantage to the student. There is a lesson for our junior organizations in what Sir Alexander suggests to Engineering Colleges. He says:

> To get the full benefit from its best pupils, a college should, if possible, keep in touch with them after they have left it. A few years after they have left college, and when they have fairly got into the swim of professional work—but before they have so much lost touch with the difficulties of their college days that they no longer appreciate the student's point of view—they might be made to help in teaching by giving lectures on the special branches of engineering with which they are specially and actively familiar. They should do it before they have forgotten what they formerly learnt, or have had it driven out of their heads by the pressure of other ideas, and while college methods and points of view are still familiar.

Do not the junior organizations see from this that they have something to gain by association with the senior organizations, as thereby they will keep in existence a stronger bond between themselves and those of their members who pass to the senior organizations, and secure from them occasional service which they of all men called to higher positions will be most capable of rendering? Meantime, the senior organizations all possess men who are within a shorter distance of their period of training than many of the older members; and therefore these are the ones who are most capable in the present of putting before the juniors, in occasional lecture or paper, notes from their practical experience in responsible work in a manner that will be appreciated and fully understood. In other words, they are the men who can put themselves in the place of the juniors better than the men farther removed from their days of training. It is not difficult to see great advantage in unity between the senior and junior organizations.

North British Association Meeting.

The North British Association of Gas Managers, after various wanderings over the length and breadth of the land, settled down for a couple of days last week in the land of their nativity; for it was in Cupar, the county town of Fife, that the Association was brought into being. That after forty-four years of most strenuous existence, it is fuller of life and resource than ever, was manifested by the gathering which assembled last Thursday, under the presidency of Mr. J. W. Carmichael, of Barrhead, in the Great Hall of the United College of St. Andrews. It was an appropriate coincidence—perhaps not altogether unintentional—that when the Association were meeting in their native county, their deliberations should be presided over by a native of the town in which the meeting was held. Mr. Carmichael was a pupil of Mr. Jesse Hall, the venerable Manager of the St. Andrews Gas Company, who is the oldest gas manager in Scotland, and who was President of the Association at the last meeting in St. Andrews—twenty-seven years ago. Mr. Hall, it is a pleasure to know, is still in harness, and was on the platform to support his former pupil; and not only so, but he contributed to the proceedings—both of which circumstances evoked feelings of the highest gratification among the members.

Mr. Carmichael's Inaugural Address dealt with present-day topics, and contained neither high-flown aspirations nor melancholy reflections, but discussed, as a business man should, the business lying to the hand of the ordinary gas manager. A pertinent suggestion he made was that with reference to the formation of District Associations in Scotland, which might be productive of much good, as the Waverley—which is in reality a District Association—already is. A remark which may be scheduled with this suggestion, and which is worthy of reference, is his kindly allusion to the formation of the Scottish Junior Gas Association. As regards this body, it is evident the North British Association entertain no jealousy.

Mr. A. Yuill, of Dundee, read a paper upon the commercial management of gas-works, but which, as he explained, he restricted to the subject of the assessable value of gas-works and the resultant taxation upon them. The author did not essay to deal with the larger question of the principles of the practice of valuation, which so many have spent their energies in endeavouring to improve—it is to be feared without very much result. But, accepting the present method as possessing the sanction of the law, he showed how its application is habitually made to bear heavily upon gas undertakings, and how, to those who make themselves familiar with the subject, a little effort will bring them a considerable measure of relief. No theory was put forward, but concrete instances—his own case, which was amicably settled with the taxing body, and that of the Kirkcaldy Gas

Company, which was decided in the Court of Session only last year. Both cases resulted in a reduction of taxation; and, their eyes being now opened, gas managers will have themselves to blame if they do not secure in the future the advantages which are within their reach. The subject is a complex one, as was said by more than one speaker. It was so instructively handled that Mr. Yuill's paper should be carefully studied, and particularly the table he gave of the relation between capital and taxation per 1000 cubic feet of gas sold, in which individual managers will find much to set them thinking.

The paper by Mr. W. B. M'Lusky, of Perth, on "Gas "for the House," had for its chief feature a suggestion for a far better working understanding between gas undertakings and the traders in every town. The set of regulations he suggested seem to be moderately pitched; at all events, they appealed to the intelligence of the members, and were the means of provoking a good discussion, in which the views of traders as well as managers were mingled. The object is to unify a trade which is at present conducted upon lines that are by no means clearly defined or understood. Mr. M'Lusky's scheme is sufficiently elastic to allow of its application in part as well as in whole; and as it is manifestly a fair proposal, it will bear looking into. Almost upon a kindred subject, Mr. Allan Reid, of Brechin, treated of "Competition of To-Day," in a paper which was accorded a very complimentary reception.

The Association again took up the question of affiliation with the Institution of Gas Engineers. At the meeting in Glasgow last year, the Association unanimously resolved not to affiliate. Since then, further communications on the subject have passed between the Council of the Institution and the Committee of the Association, the Council being anxious to remove, if possible, some of the conditions that were believed to prevent the North British Association from throwing in their lot with the general body. The endeavour has not been successful, as, on the motion of the President, last year's resolution was repeated. The Association are resolved to stand aloof, apparently because by joining they would be admitting that they are a District Association. They claim to be a National Association, and the pioneer Association, and will not take second place. But in the remarks of the President there is nothing which precludes the Council of the Institution from coming forward with another proposal, should they think it is worth their while to continue the process of wooing the Scotsmen. From all that was said on Thursday, it would appear that the question is only one of terms; and that if the North British Association were offered the position they consider themselves entitled to, the Institution might have them in their midst. Reading between the lines the remarks of the President, the *impasse* does not appear to be so formidable as it was a year ago.

A Comparison of Water-Gas Systems at Amsterdam.

It will be seen by the report of the proceedings at the annual meeting of the Dutch Association of Gas Managers at Amsterdam which appears in another part of the "JOURNAL," that the members and visitors were not only most hospitably received by the authorities and the officials of the Gas Department, but were provided with much food for reflection on their return to their respective homes. The two gas-works, which are under the control of the Municipality, were thrown open, and particulars as to their progress since their acquisition on behalf of the city were freely afforded. Two features of the meeting were, one might almost say, unique. In the first place, the visitors were able to partake of luncheon under the huge gasholder which was described in the "JOURNAL" a fortnight ago; secondly—and this was a far more important matter—they were able to see installations of two different systems of producing water gas. At the Amsterdam West Works, they found in operation plant on the Kramers-Aarts system capable of producing about 2¼ million cubic feet of "blue" water gas per 24 hours; while at the East Works they had an opportunity of inspecting the installation of carburetted water-gas plant, of similar capacity, which has been put up by Messrs. Samuel Cutler and Sons. It is not our purpose to discuss here the relative merits of the two systems. Full descriptions of the plant will be found elsewhere; and the general report includes some valuable statistical particulars of working furnished by Heer van Rossum du Chattel. These will be left to speak for themselves. Dr. Ferneden, who read a paper in which he recounted his experience with the Kramers-Aarts system, confessed that its installation and working had not been altogether plain sailing. However, the initial difficulties appear to have been successfully overcome, and the plant is now running smoothly. He thinks the preliminary results justify the conclusion that "the Dutch system of producing water gas may be freely compared with the long-tried foreign systems;" as to whether it is better or worse he was careful not to give an opinion. He left the future and the judgment of the members to determine this point. With regard to the other plant, however, a very definite opinion was expressed in the course of the meeting, as will be seen from our report, by one who was competent to form it; and it must have been highly gratifying to the representative of the makers to learn that their contract had been executed so satisfactorily.

The Use of Cement for Pipe-Joints.

As readers will doubtless have noticed, the subject of the use of cement instead of lead for making the joints of gas-pipes was brought before the members of the Western (U.S.A.) Gas Association, at the recent annual meeting, in a paper by Mr. Jacob D. von Maur, of St. Louis. The circumstances which led to the preparation of the paper were set forth in the full abstract which appeared in the "JOURNAL" last week. Put succinctly, they were an objection raised by a public official to the use of cement for the purpose named, on the ground that the joints would leak in the future, and consequently necessitate the opening of the streets in order to make the necessary repairs. This attitude evidenced a want of confidence in cement as a joint-making material which the author did not consider was justified by general experience; and in order to satisfy himself on the point, and at the same time the official in question, he decided to thoroughly investigate the whole subject. He accordingly addressed a circular-letter to all the leading gas companies; taking special care to select those whose answers, when compiled and tabulated, would represent the average judgment of the gas engineers throughout the country. This was a perfectly legitimate use of the "circular of inquiry;" and its object was fully appreciated. Eight questions were put, and answers were returned by the receivers of 52 out of the 60 letters sent, accompanied in many cases by a request for a copy of the report when the investigations were completed. But the President of the Laclede Gas Company—the one immediately concerned in the matter—thought that the collected information should have wider circulation; and he therefore asked Mr. von Maur to embody it in a paper for the Western Association. For comprehensiveness, we do not think it has been equalled by any communication dealing exclusively with this subject submitted to a technical society. The author has made out a good case for the substitution of cement for lead on the score of economy; and it would appear that the former material is as much to be relied upon as the latter. Certainly, it can be manipulated by workmen who are less skilled than those required for making lead joints. As will be seen from the report of the discussion on the paper which appears elsewhere, some objections were raised to the use of cement in pipe-laying; but they were answered categorically by the author, who maintained the position he took up. The paper and the remarks upon it are worthy of careful perusal.

An Echo of the Havre Congress.

At the annual meeting of the European Gas Company, a report of which appears in another column, the Chairman, Mr. R. Hesketh Jones, had a satisfactory condition of affairs to report. Decreases in consumption, owing to bad trade in some of the towns supplied by the Company, were balanced by increases in others, with the net result that there was a growth of ¾ per cent. in the quantity of gas sold, and of ½ per cent. in the rental. This is not, perhaps, in itself a very large gain; still it is on the right side. Also the fact should not be overlooked that there has been an increase of 4½ per cent. in the number of consumers during the year, which has, of course, added considerably to the stability of the Company's business, as well as helped to assure a continuance of the usual dividend of 10 per cent.—and the bonus. But the announcement of the past year's results occupied only a part of the attention of the meeting; for the Chairman and other

speakers had another matter of considerable interest upon which to dwell. This was the recent meeting of the Société Technique in Havre, a lengthy account of which duly appeared in the pages of the "JOURNAL." This meeting proved a happy event for the European Gas Company in more ways than one. It enabled the Directors who went over to meet all the Managers, and to discuss with them various matters of interest to the undertaking in a manner which is likely to bear good fruit. It also furnished them with an opportunity of showing the members of the profession who attended the congress the excellent character of the works which the Company possess for supplying Havre with gas. There was also another matter in connection with the meeting which could not fail to afford gratification to the Directors and shareholders of the Company; and this was the proof that was afforded, by the remarks of the Mayor of Havre, of the good feeling existing between the authorities and the Company's local Manager (M. Gaston Gautier). This pleasing feature was commented upon in the "JOURNAL" at the time; and it goes far to prove the truth of the remarks that were made by the Chairman, Mr. H. E. Jones, and Mr. R. S. Gardiner as to the efficiency of the Company's staff. Amicable relations between the authorities and the managers in towns which they supply with gas are, with undertakings like the European Gas Company, as the latter gentleman said, a very important consideration.

Gas Affairs at Manchester.

The adoption last week by the Manchester Corporation Gas Committee of their annual report for presentation to the City Council was a pleasant function; for the operations during the financial year to March 31 of the department of which they have charge were of a gratifying character—thus permitting of the preparation of a document that will be satisfactory to all concerned. Under the prevailing conditions, a large increase in consumption was, of course, hardly to be expected—in fact, so many of the important industrial centres have had to record a falling off in the quantity of gas sold during the past twelve months, that a similar experience in Manchester could not have occasioned any great surprise. The Committee, however, do not have to chronicle a decrease, but a slight gain, which, in turn, follows an increase of 3¼ per cent. in the previous year, though the income is not correspondingly greater, owing to the fact that during nine months out of the twelve the price of gas was 2d. per 1000 cubic feet cheaper than the preceding year. Next year's income will also be affected from a like cause; for a further reduction of 1d. per 1000 cubic feet has been made as from the end of last quarter. The Committee are contributing £60,000 in aid of the rates; but this was only rendered possible by the fact that the actual net profit exceeded the estimated sum by nearly £20,000—being £66,067, instead of £46,639. Thus, after handing over the amount named, there is still a good £6000 to be devoted to paying for extensions of works where borrowing powers have not been granted, to the purchase of stock for cancellation, and to the transfer of a substantial sum to reserve. In the particulars to hand there are several items on which the Engineer (Mr. J. G. Newbigging) is especially is to be congratulated. The first is an increase of 100 cubic feet per ton (to 10,967 cubic feet) in the make of gas, which follows an almost as great increase in the previous year. Next, there is the unaccounted-for gas, which exhibits a decrease of close upon 1 per cent., to the highly satisfactory figure of 2·88 per cent. In fact, more than the whole of the additional £20,000 net profit above the estimate was realized by a saving in expenditure, for the income was some £8000 less than was expected—which means that really the expenditure was nearly £30,000 below what was calculated would be the case. The number of consumers is making gratifying headway; and in Manchester, as elsewhere, the prepayment system is growing rapidly in popularity. The several reductions in price which have recently been made are potent factors in increasing the popularity of gas—far more so than the handsome contributions which are made in aid of the rates.

The Birmingham Blue-Book.

Some slight idea may be gathered of the magnitude of the work carried on under present-day conditions by the large English Municipalities, by a glance through the annual book of accounts of the Birmingham Corporation, for which the Treasurer of the City, Mr. Thomas H. Clare, is responsible. The issue for the year ending March 31 last, which is now before us, extends to over 300 pages; and the proportions of the figures dealt with are, of course, enormous. During the past many years the income has gone on increasing, until the receipts from all sources for the twelve months under review amounted to the princely sum of £2,627,529. But it must not be imagined that growth of revenue arises entirely from increased assessment values; other forces have also been at work. For instance, as recently pointed out by Alderman Clayton in the City Council, there has been an increase in the rates of 1s. 3½d. in the pound during the last thirty years (though it should be mentioned that 1s. 2d. of this has been absorbed by education); while the Gas Department yields much larger profits now than was the case in 1875. In addition to these considerations, the Local Government Act of 1888 has provided largely increased contributions from the Imperial Exchequer. The necessity for such an income proves, of course, that the expenditure is correspondingly heavy, though it is to be remarked that, with an income of some £130,000 more than in 1903-4, the outlay (£2,524,365) was about £4000 less. The result of this gratifying condition of things is that, whereas in the previous year there was a balance of expenditure in excess of income of £32,112, on the present occasion this has been converted into an excess of income amounting to £103,164. The total rates for the year were 5s. 8d. in the pound on a gross assessment of £2,858,873; the borough rate of 3s. 6d. in the pound producing £499,650, and the improvement rate of 2s. 2d. in the pound £249,365. The net expenditure of capital during the twelve months was £703,857; while the gross capital outlay to the end of the year was £18,842,278. The sum provided during the year for the redemption of debt was £258,462; the gross amount set aside for this purpose up to March 31 (loans paid off or provided for) being £3,831,853. The balance of expenditure on capital account remaining at the end of the financial year to be met was £15,010,426, exclusive of loans raised for the Birmingham Tame and Rea District Drainage Board (£387,764), and the Guardians of the Poor of the Parish of Birmingham (£83,198), to be repaid by them. This balance was made up as follows: Borough fund and rate and improvement rate accounts, £3,389,465; dwelling-house improvement fund, £1,370,996; gas account, £1,809,477; water account, £7,666,009; electric supply account, £625,861; tramways, £148,617. The total amount of annuities, loans, bills, and stock outstanding on March 31 was £16,211,022; while the total amount of the gas, electric supply, and tramways reserve funds provided out of revenue to that date was £155,877.

Trading in Monopolies.

At the same meeting of the City Council at which Alderman Clayton reviewed the financial position of the city, he touched on the question of municipal trading; stating that in this direction Birmingham always confined itself to monopolies, excepting in the case of gas-fittings, about which, as readers are aware, there has of late been some stir made. These monopolies, he pointed out, were water, electric supply, gas, and trams; and all of them involved interference with the surface of the streets, which was an important reason why they should be under the control of the Corporation. There are many other popular forms of municipal trading in which Birmingham has no part—steamboats being one of the dozen or so examples named by Alderman Clayton. As to the gas undertaking, he mentioned that since 1875 the capital employed had actually been reduced by £106,000, while at the same time they made 2¾ times as much gas; and their prices compared very favourably with other places, having regard to the great distance the coal had to be brought. The electric works, he added, were in a state of transition. They were not bolstering up the concern by lighting the streets with the current in order to make a trade. It was admitted that the present lighting of the streets with gas was cheaper and more effective. We have already published particulars regarding the operations of the gas and water works during the past year; but a few additional figures may be quoted from the Blue-Book. The revenue account of the Gas Department for the year 1904-5 showed a balance of income over expenditure of £172,839; while after providing for annuities, interest, and redemption of debt, the balance of the profit and loss account was £50,526. The amount of capital expended

during the year was £74,373; and the value of buildings and plant abandoned, &c., was £61,232. The total capital outlay to March 31 was £2,566,904; while the reserve fund remained at £100,000. The gross amount of loans negotiated, including annuities, was £2,908,949. The amount provided from revenue for redemption of debt during 1904-5 was £39,290; the total sum so allocated being £757,427, and the balance outstanding £2,151,522. The revenue account of the Water Department for the past year showed a balance of income in excess of expenditure of £164,909; while the profit and loss account showed a loss of £91,826. The total capital expenditure is no less than £7,856,527; and of this £7,719,842 remains to be provided for. The Electricity Department had for the year to March a balance of income in excess of expenditure of £39,574. The total capital expenditure on the undertaking to date was £665,424; there having been an outlay during the year of £50,435. The gross amount of loans negotiated was £713,929, of which £674,366 remained to be provided for. The amount of the reserve fund provided out of revenue, with accumulations, was £49,394. These figures represent undertakings of such magnitude that with them, and their various other duties, the Corporation must be pretty fully occupied. This would seem to prove the wisdom of Birmingham confining its trading operations within such well-defined limits.

WATER AFFAIRS.

The Nationalization of Watershed Areas.

THE recent conference of the members of the Royal Sanitary Institute at Cambridge afforded Dr. Sims Woodhead, the Professor of Pathology in the University and Consulting Medical Officer to the County Council, an opportunity of emphasizing once more the necessity for placing the unappropriated watershed areas of the country under the control of some central authority who would deal with them in the best interests of all the parties concerned. The subject has been referred to from time to time in our columns, and there is consequently no need to repeat arguments in support of some reform being effected in the existing system. Dr. Sims Woodhead was discoursing more particularly upon rural water supplies, and he pointed out the difficulties experienced by the local authorities in obtaining pure water, owing to the selfishness and inconsiderateness of individuals and communities. When these parties are located upon the banks of a stream, they are very careful to take their own supply from it at a point above them; and, in return, they discharge into it their sewage in a more or less crude form —thus rendering it harmful to those who are immediately below them. When, in addition to this, the springs and wells in one district are contaminated by the sewage from another, the chances of finding reliable sources of pure water become remote. The selfishness which brings about this condition of things can only be effectually counteracted by the constitution of a central organization not only to prevent such pollution, but to control water supplies generally. Dr. Sims Woodhead is satisfied that co-operation and adequate filtration are required to ensure purity of supply in both rural and urban districts. There is plenty of water, even in dry years, if it could only be properly purified and equitably distributed. A step in this direction has already been taken in Essex; and the example might be beneficially followed elsewhere. What is found to be advantageous on a comparatively small scale would be equally so on a large one. For example, as Sir Melvill Beachcroft, the Chairman of the Metropolitan Water Board, has pointed out, the contingency of London having to resort to a fresh watershed in order to supply the needs of an increased population in the future may have to be considered before very long; and when the time comes, no selfishness on the part of its possessors should be allowed to stand in the way of its acquisition, on adequate guarantees being given that local rights and interests would not be detrimentally affected. Here the services of a National Water Board, such as that suggested by Dr. Sims Woodhead and others, would be found valuable; and not only in the case of London, but in that of other cities and towns that are or may be dependent upon distant watershed areas.

Reinforced Concrete in Water Engineering.

THE employment of metallically reinforced concrete in the special class of construction connected with water supply is a subject upon which water engineers, speaking generally, have had but limited practical experience in this country. As much was admitted by the President of the British Association of Water-Works Engineers (Mr. P. H. Palmer) in his admirable Inaugural Address; and the report published in another column does not disclose the name of a single engineer with such experience among those who addressed themselves, at the Hastings meeting, to the consideration of the useful paper by Mr. Easton Devonshire, on "Steel and "Concrete Construction at the Antwerp Water-Works." They were all inquirers; and no one spoke of personal work in this direction. Mr. Devonshire's paper will, however, serve the valuable purpose of directing attention with more prominence than hitherto to the question of bringing to the aid of the economics of water engineering a modern method of construction which has been looked upon somewhat sceptically in the high quarter from which sanction proceeds to loans for municipal works. It is right for the Local Government Board to protect the ratepayers against expenditure in which there is any trace of uncertainty; but it is wrong if any old-fashioned notions of engineers who are not now in practice should debar Municipalities from the enjoyment of constructional methods which will assist them in building works with greater economy. Papers like the one under notice should help to free their minds from doubt.

Concrete construction, with expanded metal as a reinforcing element, is not a thing of yesterday; and in other branches of engineering, there has been very fair experience with many forms of fortified structure. And it is a striking fact that those engineers who have had this personal experience are those who speak strongest, and consistently, in praise of the use of armoured concrete. It would have been interesting if the President had been able to secure the attendance of Mr. C. E. Botley at the meeting, to speak of the construction with reinforced concrete of his immense water-tanks under the coal-stores at the new gas-works at Glyne Gap. Having said so much, it must still be confessed that opinion is by no means settled among authorities as to the resistances that can be properly attributed to the embedded metal. The special investigations that have been made have been on a comparatively small scale; and the conclusions derived from them have not met with general acceptance as applying to work upon a large scale, with surfaces of any considerable extent exposed to varied stresses. Diverse method, too, is applied to the embedding of the metal; nor is there agreement among constructors as to which is best. But while there is much more to be learned before truths and principles are reduced to a universally acceptable level, belief in the fortifying and economy producing capacities of the system is spreading daily.

But we still want to know more (though local conditions will always alter cases) as to the cost of structures built by this method under well-defined circumstances, so that the circumstances may be compared with those existing in other parts of the country. That is where Mr. Devonshire's paper fails in giving satisfaction; but that to an extent is not his fault. For the size of the reservoir described, he shows a remarkably cheap piece of work; but he admits that labour is cheap in Belgium. This somewhat destroys the value of his figures, because there are, from the paper itself, no possible means of measuring the effect of this cheap labour on the total cost against what would result from the employment of dearer labour in this country.

We have received from the Superintendent of the Department of Technology of the City and Guilds of London Institute (Sir Philip Magnus) the names of prize winners in the last examinations in "Gas Manufacture," a list of the successful candidates in which was given in the "JOURNAL" for the 13th ult. (p. 847). The winner of the first prize in the Honours Grade (£2 and the Institute's silver medal) is Mr. M'Leod; the second prize (£2 and the Institute's bronze medal) being taken by Mr. R. Hayes Collins. In the Ordinary Grade, the first prize (£1 and the Institute's silver medal) was won by Mr. Frank A. Jenkins; the second (£1 and a bronze medal) by Mr. Clarence Harris; and the third (a bronze medal) by Mr. E. Foulkes Jones. The money prizes are given by the Salters' Company. Mr. M'Leod studied at the Glasgow and West of Scotland Technical College; Mr. Collins and Mr. Jones, at the Regent Street Polytechnic; Mr. Harris is also a London man; while Mr. Jenkins is a pupil of Mr. T. Berridge, of Leamington, and studied in the Municipal Technical School.

NOTES FROM WESTMINSTER.

WITH the defeat of the Government and the overthrow of the scheme for bringing the London County Council's tramways over the bridges and along the Embankment, there was a fair amount of excitement at Westminster during the past week. Whatever may be our individual views, looking at the position of things generally, it certainly seems that the time is ripe for a fresh appeal to the country; and for the convenience of the promoters of Private Bill legislation, it would be better that this should happen during the coming autumn than that a fresh session should be commenced with a cloud of uncertainty hanging over it. The present session has been one that is without equal during recent years in respect of the paucity of Private Bill work; and no one who studies the matter can come to any other conclusion than that the promotion of private measures is, wherever possible, being deferred as long as may be, in order to run no risks and in the hope of more peaceable times. The hope of the latter condition cannot possibly be realized until after the next General Election. The Administrative County of London and District Electricity Supply Bill has been occupying Sir James Kitson's Committee in the Grand Committee Hall throughout the days and times devoted to sittings during the week; but flat and dull has been the work that has engaged attention in the ordinary Committee-rooms. Never have we known fewer Committee rooms simultaneously occupied in a session than has been the case during the present one.

The London Electricity Power Bill. The proceedings connected with the Administrative County of London and District Electric Power Bill have during the week produced two important features which have somewhat changed the situation, and have given the many opposing authorities and companies additional ground for despair. One is the production of the purchase clause, and the other the schism in the ranks of the opponents. The purchase clause was promised in the Commons on second reading; and the promoters were ordered, much to their disgust, to produce one early during the sittings of the Committee. Naturally, the promoters being the authors, the clause is a more advantageous one to them than is the ordinary clause applying to electricity companies under the General Acts. It proposes that, in the event of any public authority or body of trustees being given authority by Parliament to acquire the undertaking of the Company at the expiration of fifty years, or at subsequent periods of ten years, the purchasing authority shall give twelve months' notice of their intention to purchase; and the price to be paid shall be equal to the amount standing in the books of the Company as representing capital expenditure, without any allowance for compulsory purchase, goodwill, or prospective value. The length of time before purchase can take place, and the fact that the purchasing authority are not specified, are the two main objections to the clause; but it is rather impossible, and in fact it is better for the promoters not, to name a purchasing authority, seeing that there is no authority at present in existence who possess the complete confidence of the ratepayers to such a degree that Parliament can say to-day who will be the best possible authority to undertake this supply half-a-century hence. The promoters themselves, and we agree with them, are of opinion that a long period will be required within which to attract subscribers and to establish the finances of the undertaking. With regard to the second matter, the Stepney Borough Council have weathered the Metropolitan opposition by entering into an agreement to take from the Administrative Company all the electricity they require beyond what the present local generating-station is capable of furnishing. Bexley, Barking, the Kent Power Company, and the County of London Electric Supply Company have also entered into agreements with the promoters of the scheme. In the case of Bexley and Barking, the Administrative Company are contemplating the taking over of the electrical undertakings of the District Councils. The agreements in these cases deal with the general supply; and in the instance of Barking, the figures in the agreement will dissipate the idea that has become prevalent through the clever advertisement the scheme before Parliament has been given, that consumers generally are going to get electricity at less than 1d. per unit. For power and traction purposes in Barking, the price is to be 1d.; for public lighting 1½d.; and for private lighting 4d. per unit—the last-mentioned charge to be reduced 5 per cent. in three years, and a further 5 per cent. the following two years. These are not the prices that have been so much talked about; and they are not the prices that the Gas Company will look upon with any apprehension, if fair play as between them and the Administrative Company is given in the matter of public lighting. Of course, before anything can be effected on these agreements, Royal Assent has to be given to the Bill, and the Board of Trade will also have to be consulted. Connected with the proceedings before the Committee it is convenient to notice here that the London County Council have passed a resolution urging upon the Government the desirability of the Administrative Company's Bill being rejected, and suggesting a Joint Select Committee or a special tribunal being appointed to consider the whole question of the supply of electricity in London. It is not often that we are in agreement with the London County Council; but what they are proposing is exactly what was regarded in the "JOURNAL" as the proper course of action away in the beginning of the present session.

Bolton Water. The Bolton Corporation water scheme has been before the Duke of Northumland's Committee; and there are two or three points about it which should be noticed. It is considered by all the experts called by the Corporation that the scheme will supply the wants of Bolton for 35 years to come, and is the most feasible project for dealing with the position in which the borough now finds itself. There was opposition, however, from various people, among them Messrs. Deakin, who are the owners of certain bleach works at Belmont. But a hint from the Chairman, and a night's repose, brought the parties before the Committee with an arrangement which was mutually agreeable. It provides for 1¾ million gallons per day being allowed to pass down the stream as compensation water for 311 days in the year. District Councils surrounding Bolton also claimed equalization of rates; and traders outside Bolton pointed out to the Committee how they suffered by being compelled to pay 9d. per 1000 gallons, against 6d. inside the borough. The upshot of considerable discussion was that the preamble of the Bill was found proved, subject to the condition that the domestic supply must be on identical terms both inside and outside the borough, and that as to trade supply, traders should be at liberty to go to Manchester for their water if they wished, and the Manchester Corporation would supply them—the Bolton Corporation waiving all right to veto. This is a simple and singular arrangement; but we fancy that Manchester will not be found going out of their way to meet the demands of a few discontented traders near Bolton.

Corporation Supply of Electricity. The Wigan Corporation Bill raised some interesting points as to the supply of electricity outside the municipal area, which, in our opinion, ought to be rigorously forbidden, instead of countenanced, by Parliament. The Bill, among other things, proposed to authorize the transfer to the Corporation of Electric Lighting Orders obtained by other authorities. The Corporation already supply electricity in bulk, but are now proposing to take upon themselves the distribution of current within the areas of outside authorities. The Lancashire Electric Power Company had a strong antipathy to the proposal. The Committee of the House of Commons who were considering the Bill last week, however, allowed the Corporation to take over the Ince Electric Lighting Order; but very properly refused the application with regard to all other districts.

Shepton Mallet Gas Company and Electric Lighting. The Shepton Mallet Gas Company have got their Bill through which permits them to supply electricity within the area of the gas supply; the only loss being the bulk clause, which has been eliminated.

ELECTRIC LIGHTING MEMORANDA.

The Electrical Tariff Question — The Supply of Outlying Areas — Municipalities and Power Companies—Overthrow of the London County Council Fittings and Wiring Clauses—Municipal Deficiencies and Extravagances.

SINCE the report of the proceedings at the annual meeting of the Incorporated Municipal Electrical Association was published, we have been trying to find among the papers and the discussions one subject at least affecting policy upon which it could be said that municipal electrical engineers or members of municipal electricity committees are of one mind. But positively we have to confess to failure. So far as references have already been made to the papers and discussions, that has been seen; and the differences of opinion that have ruled in connection with them it must be said, supply one of the outstanding features of the whole proceedings. There was one paper in which this forced itself to notice in a very pronounced manner, and that was the contribution by Mr. Hamilton Kilgour, of Cheltenham, on "Costs and Tariffs for Electric Supply." This is a subject of perennial interest to electrical engineers and managers. In science, electrical engineers are cradled, by scientific methods their works are conducted, and with scientific exactness they carry out their works' costs to the infinitesimal. Of all this no one would complain, if only they would condescend to keep it at home, and outside their generating stations become practical commercial men, and deal with their electricity in a business-like way. But instead of this, they seem to delight in causing as much confusion as possible throughout their dealings with the public. Electricity is a strange commodity; and most electrical people think it only right to apply this characteristic to the end, and to make as much of a mystery of it as can be. It ought not to be, so these ultra-scientific gentlemen think, subject to ordinary business methods and price.

We have read Mr. Kilgour's paper; but there is not space here even to summarize it. Readers may take it from us, however, that there are a hundred-and-one things to be duly considered before total costs are arrived at; and then allowance has to be made for the "characteristics in regard to liabilities" of the various classes of consumers—those for lighting, motors, public lighting, and traction. These liabilities (which would make the

butcher, baker, and other tradesmen scratch their heads a bit) appear to be such things as these: "(1) Maximum demand—possible and probable; (2) the time or times at which the maximum demand occurs; (3) the duration of the maximum demand, or of a demand nearly equal to the maximum; (4) the degree of knowledge possible with reference to the variations of the demand with time; and (5) the periods, if any, during which supply may be discontinued." And then the members of municipal authorities are constantly grumbling about giving their electrical engineers and their technical assistants a few pounds a year increase in their remuneration—more especially where net profits do not obtain. The consideration of the question of tariffs alone is almost enough to eventually land these officials in lunatic asylums. But this in only a side question. After mastering all the circumstances bearing upon the question of the price to be charged for each class of business, the Committees have—sometimes they give their consumers—the choice of saying whether they will pay upon a flat-rate or on the Hopkinson or the Wright system, the last-named of which is very generally adopted, and is just as generally despised by the man who is accustomed to paying so much for a given measure, with perhaps a discount for prompt payment and for taking a quantity. However, most of the aldermen and councillors who spoke in the discussion on Mr. Kilgour's paper do not like the fantastic maximum-demand system; and those gentlemen after all represent the views of the "man in the street," who, even if an electricity consumer, has rarely a clear conception of what this system of charging really means. Alderman Pearson, of Bristol, has had it explained to him many times. We hope he now understands it, because he has "explained" it to fifty other people, and as the result there are now 49 different opinions afloat in Bristol as to what he was endeavouring to elucidate. There is no doubt that there is a movement proceeding favourable to the institution of a common and understandable system of charging; and the sooner this comes about, the better for the electrical industry. The present uncertainties and peculiarities in charging only breed dissatisfaction. This advantages the gas industry more than the electrical; so perhaps we ought to say "Let the uncertainties and peculiarities continue."

There was another paper, on "Extensions to Outlying Areas" by Mr. A. B. Mountain; but we fail to find anything in his argument to justify municipalities in going beyond their boundaries and supplying electricity to districts in which the demand must of necessity, through sparseness of population, be small and the capital expenditure on the distribution system and the leakage heavy in relation to the business done. The author regards it as "the actual duty" (in reality it is a poor excuse for grabbing territory to give play to the feverish anxiety for fresh fields for municipal trading) of all the large central authorities to extend their electric supply mains into the districts immediately surrounding the central area, "if it is considered probable that future extensions of the boundaries will bring these districts under the control of the central authority." It is bad enough to have a local authority engaging in speculative undertakings in their own area; but to allow them to extend the hazard by going into areas where they have no claim whatever upon the ratepayers is, to say the least, grossly unfair to their own ratepayers and consumers. There is little to be gained from such trading; and the chances are greatly in favour of loss. Mr. Mountain himself confesses that the revenue obtainable from the outer districts is usually small in proportion to the capital expended; and although the price may be increased to the statutory limit, this will tend to reduce the demand, and be of little advantage. Where, then, does the "actual duty" come in. Parliament has connived at this kind of thing in the past; but with the expense of the proceedings in Parliament, the capital expenditure involved in such extensions, the increased management expenses beyond the borough per consumer, and the, as a rule, smaller consumption per consumer as compared with the interior district, are all against such trading as this being remunerative. It is manifest that municipalities are not all of one mind regarding this extension of their territory into the thinly populated environs. But from a paper and discussion on the supply of electricity in industrial areas from a municipal point of view, which is altogether another matter, it seems that the municipal point of view is, generally speaking, that local authorities are all-sufficient for meeting the competition of the power supply companies, and that they will not entertain any idea of taking electricity in bulk from such companies. Who can say what time will bring forth in this respect, notwithstanding the heavy distribution expenses that will devolve upon the power companies? Their advantages at the generating station are not the only considerations; and on this the municipalities are building hope of prediction being falsified by experience. However, there is no doubt that the interest of electricity distributors is increasing in the matter of purchase in bulk. This is apparent from the reports that come from different parts of the country. Willesden last year made a profit of £204 on its electricity undertaking; but it is stated that if they had not purchased electricity and had generated it all for themselves they would have lost £2129. The Birstall Council have concluded negotiations for a supply in bulk for fifteen years with the Yorkshire Electric Power Company; and application is being made to the Local Government Board for a loan of £2000 to carry out the necessary work. Compare this capital with what would have been required for a generating station if the Council had decided to have one on their own account. The South Wales Power Company, too, are very active; and it is said that the Margam and Britonferry Councils have entered into an agreement for power supply in their respective districts.

It was an unfortunate thing for the wiring and fittings clauses in the London County Council (General Powers) Bill, but fortunate for most people interested in them, that they should have come before a Lords Committee over which the Duke of Northumberland was presiding—seeing that the Duke has rather a close acquaintance with the subject of municipal trading in electricity, and his name is attached to the clause which has superseded and improved the old Bermondsey clause. The Committee did not trouble the opposition much, nor did the promoters trouble the Committee a great deal. We have an idea that the Council were not so eager to take the clauses with the restriction imposed by the Commons Committee, as they have been to get them in their unfettered state session after session. The Council called no evidence; Mr. Freeman, K.C., simply contenting himself with a plain statement on the question. The Electrical Contractors were prepared with a strong body of evidence; but one witness on their behalf sufficed. The Chairman applied the closure; and the Committee struck out the clauses bodily. The Gas Companies, of course, were not so interested in the matter on this occasion as they were before the Commons Committee decided that, if this business was entered into by the Borough Councils, there should be no mistake about it being self-supporting. On all hands, there is pleasure that the County Council have again been defeated; and should the Council continue their insane perseverance in trying to gain such unpopular powers for general application in London, they will find the case of the opposition has been considerably strengthened by what has happened this session. If the Borough Councils are anxious to get these powers, let them each ask Parliament for them on their own account, and have their own particular case threshed out on its merits. Nothing will please the County Council better than to tie the Borough Councils as tightly as possible to their apron-strings; and the pretty little devices in which the Borough Councils are concerned all contribute to this end.

The accounts of municipal electricity undertakings have a way of veering about in most singular fashion. The people of Oldham are just now concerned over a loss of £1306 last year; and this follows on a deficiency of £771 the previous year. This we believe is the eleventh year of the working of the Electricity Department. In four of the years, there have been deficiencies; and in the remaining years (excepting in 1903, when the profit mounted up to £5300, owing to 2d. per unit being charged for traction purposes, instead of 1½d. as now) there have only been a few hundreds surplus each year. One of the local papers has tried to console the ratepayers of industrial Oldham by telling them that the charges for tram and lighting purposes are on a lower scale than is usual. But if the ratepayers of Oldham could only see the returns applying to the country generally, they would find that the charges are not by any means uncommon. The Corporation have built new electricity works, which are too large for their requirements; and so they are necessarily a burden beyond the needful upon the ratepayers. This is most unfortunate, as the ordinary electricity business does not appear to be very flourishing in Oldham. The increase in consumption last year amounted to something less than 32,000 units; while the revenue decreased by £8 14s. 5d. Some peculiar results have also been disclosed in other quarters. We noted a few a short time ago, and others have since come to hand. The great city of Leeds with its tremendous electricity business only made a surplus of £282 last year. York, too, has a deficit of £2946, against a surplus of £351 the previous year. Including £1350 from a rate-in-aid and £742 deficiency at March, 1904, Ipswich shows a total deficieney of £2420, and a net one of £327 for the year. There has been an inquiry respecting the further capital requirements of the department—viz., £2438 and £12,851. An inquiry at Great Yarmouth into an application for sanction to borrow £10,000, revealed the miserable result of their trading in electricity. The expended capital already amounts to £79,979; and on one side the losses so far amount to £2711, and on the other the total profits are £4338. This cannot be gratifying to the Corporation or the ratepayers. Dorking, too, has been facing a Local Government Board inquiry; and the Inspector made some sharp criticisms on the extravagant capital expenditure. Dorking is not a large place, but it has got big electrical ideas. The first nine months' working (which ended with December last) resulted in a loss of £661; and the Council are already asking for another £12,000. It is a curious thing that at these inquiries, the ratepayers exhibit such extraordinary apathy.

Manchester District Institution of Gas Engineers.—It is proposed that the next meeting of the Manchester District Institution of Gas Engineers (which will take place on Saturday, Aug. 26) shall be devoted entirely to pleasure; and a cordial invitation is extended to ladies, who it is hoped will accompany the members. It is intended to assemble at Bakewell, have lunch at the Rutland Hotel, then drive to Haddon Hall, and from there to Matlock Bath, *via* Winster Bank, Holly Bush, *via* Gellia, and Cromford. Tea will be taken at Matlock, and the return journey will be accomplished by train. As this is a new departure, the Committee hope that the excursion will be largely attended by the members and ladies.

THE OPPORTUNITY OF GAS AUTHORITIES.

THE displays of corporation management of gas undertakings which during the past few months have been appearing in our pages, are eminently instructive—more especially to those who have had some actual experience of corporation methods when governed by party spirit. This class of reader will not require to be told that municipal management need not necessarily be associated with rancour and strife, or that the possibility being latent its development is in the main dependent upon the action of party leaders. If these be men of integrity and business capacity, they may be able to reduce to harmless dimensions the bickerings which simmer among the less consistent of their followers. But this possibility does not always become an actuality; and there are instances where the guidance of moderate men has been overthrown by an ignorant or headstrong combination of smaller minds. If, however, the leaders of the party—usually elected to the post of chairmen of the committees—are in themselves turbulent or unreasonable, then the most flagrant departures from commonsense and sound policy may be looked for.

The most satisfactory instances of corporation management would appear to be those in which Imperial party politics are excluded or relegated to a subordinate place. The reasons for such success are not far to seek. They usually mean stability in the tenure of office of the committee and of its chairman, which in turn brings continuity in the aim and purpose of the administration. They mean that the matters brought up for consideration are discussed in a calm and dispassionate manner, with a view only to the good of the undertaking or at least the well-being of the municipality as a whole. On the other hand if a decision has been arrived at, which subsequent light shows to have been erroneous, there is under the circumstances mentioned no difficulty in accepting the lessons of the experience. But if the decision is made a party question, its confirmation, continuance, or modification is often the ground for a pitched battle, which may and probably will lead to another step in the direction of perpetuating the error or maybe of jumping to the other extreme of action. Thus, oscillating between Scylla and Charybdis, does the good of the undertaking continually suffer. To the conscientious manager, such procedure is most trying; for while he is constantly striving to keep himself free from bias and laying all the facts of the case impartially before his committee, he may unwittingly offend the majority or a large minority of his masters. If he presses for the acceptance of his well-considered views—the result of many years' experience—he may be considered as attempting to dictate to his superiors in office; while, on the other hand, if he places his views before them without an adequate sense of their value, he is brushed aside and regarded as a man of straw. Be it noticed that these opposite views of his conduct may be, and often are, determined by the preconceived notions of those who judge him. The principal factor in the formation of preconceived notions is party spirit, and next to this, is the private expression of opinion based on insufficient knowledge, both of which grow into public acts of an important and far-reaching character. All experienced persons will, we think, concur in the broad statements just made, and agree that the only remedy is to appoint men of character and business capacity to administer the affairs of a corporation gas committee. What then can be said of the practice in vogue in some boroughs, of appointing to the committees not according to the worth and capacity of the individual members of the town council, but according to the ward represented, or worse still as a sop to an obnoxious or noisy critic.

We have been led into this analysis of the matter by the discussion of the Devonport Town Council reported in the last issue of the "JOURNAL;" wherein it was stated with a show of special merit—or if we may use the word "unction"—that a certain advantageous proposal had emanated from their chief official at the gas-works, without interference from any member or section of the Committee. No words could be more eloquent in showing that parties had existed in the past, who were in the habit, or were accused of being in the habit, of interfering with the proposals or suggestions of their responsible adviser. If the confession of the freedom granted to their newly-appointed Manager is an earnest of good things for the future, then it is a matter for congratulation; but it surely cannot with justice be made a ground for instituting comparisons as to the relative merits of the newly-appointed with the former official. If the Devonport Corporation are beginning to learn what is the value to be set upon disinterested advice and faithful service, they may, it is to be hoped, in due time learn that their duly-appointed representative should be shielded from petty jealousies, and that his capacity for service will largely depend on how they treat him.

Most governing bodies—including Boards of Directors and Corporation Committees of Gas Departments—recognize the great influence exercised upon them by their chief official; but it is to be feared they often overlook the fact that the official in turn is largely moulded by their action. He is consciously or unconsciously putting into action their purposes and aims; and thus he becomes part of their organized being. It therefore would be most inconsistent that they should, on the one hand, wish him to be strong and successful in the discharge of his duty, and on the other hand they should be guilty of intrigue, or of criticism in unimportant details. It is no idle metaphor, which we quote in the concluding lines, but a living, powerful force applicable to every undertaking where men must co-operate to a common end. The attainments yet in front of the gas industry call for strenuous endeavour; and if the powers that be would incite their officials to the highest service, they would meet with a hearty and intelligent response.

> Oh! help the prophet to be bold,
> The poet to be true!
> It yet remains for man to learn
> What love to man may do.

THE REPORT ON LONDON STREET TRAFFIC.

Subways and the Breaking-up of Public Thoroughfares.

IN a paragraph which appeared in the "JOURNAL" for the 4th inst., it was intimated that the report of the Royal Commission appointed early in 1903 to "inquire into and report upon the means of locomotion and transport in London" might be expected shortly; and an indication was given of the nature of the recommendations of the Commissioners. The report was issued on Monday last week, and it constitutes the first of a series of eight volumes in which the labours of the Commission will be recorded. It is expected that they will all be ready before the rising of Parliament; and when they are published they will constitute the most important treatise on the subject of street traffic and rapid transit that has yet appeared. The present volume, which consists of 123 pages and three maps, showing the street, tramway, and railway plans proposed by the Commission, will be followed by one containing the evidence; and the rest will comprise appendices to the report and evidence, maps, &c. The seventh volume—the report of the Advisory Board of Engineers and the index to it—will be a valuable one, the members being Sir John Wolfe-Barry, K.C.B. (Chairman), Sir Benjamin Baker, K.C.B., and Mr. W. Barclay Parsons, M.Inst.C.E., the Chief Engineer to the Board of Rapid Transit Railroad Commissioners of the City of New York. This, with the evidence given, some of which is of much interest to our readers—several witnesses representing gas companies having been called—will be noticed when it appears. Meanwhile, we give an epitome of the contents of the volume just issued.

The Commission originally consisted of Sir David Miller Barbour, K.C.S.I. (Chairman), Earl Cawdor, Viscount Cobham, Lord Ribblesdale, Sir J. C. Dimsdale, M.P., Sir John Dickson-Poynder, M.P., Sir Robert Reid, Sir John Wolfe-Barry, Sir Francis J. S. Hopwood, Permanent Secretary to the Board of Trade, Sir George C. T. Bartley, M.P., Mr. C. S. Murdoch, C.B., of the Home Office, Mr. Felix O. Schuster, Sir George S. Gibb, the General Manager of the North-Eastern Railway Company, and Mr. Lynden L. Macassey (Secretary). Earl Cawdor resigned in March, on his appointment as First Lord of the Admiralty. At the very outset of their report, the Commissioners recognize the magnitude and importance of the problem of locomotion in London; and they then point out that the fundamental difficulty in the way of improvement is that the streets have not been laid out on a regular plan and are not of sufficient width. A brief account is given of the measures adopted in the past for facilitating locomotion in London; and then the Commissioners submit a series of recommendations in regard to street improvements, tramways, railways, the regulation of traffic, and other matters. This leads them to the third part of their report, in which they suggest the expediency of establishing an authority or tribunal possessed of special powers in regard to questions of traffic, to be called the Traffic Board, who would deal with street improvements as well as with the provision of alternative routes and of facilities for regulating cross traffic. Its most important function, however, would be the preliminary examination, before their consideration by Parliament, of Bills seeking statutory powers for the construction or extension of "works affecting the means of locomotion and transport in Greater London." With regard to this matter, the Commissioners say that the opinion was generally expressed before them that, though Parliamentary Committees constitute a thoroughly fit and impartial tribunal, the procedure before them is "not sufficiently elastic to permit readily of the amendment or consolidation of schemes after they have been embodied in a Bill and laid before Parliament." The Board would report on the various Bills for the information of the Legislature, very much as the Local Government Board do now; and they would have the power to make suggestions for their improvement, and frame clauses for the protection of public or private interests. It is proposed that the Bills reported upon by the Board should ordinarily be submitted to a Joint Select Committee of the two Houses.

Among the questions on which the Commissioners think the Board might report is the revision and amendment of the laws regarding the breaking up of the streets. The inconvenience caused by this operation was pressed strongly upon them; and they consider the complaints made were well founded. It was suggested that in the principal streets subways should be constructed to contain the pipes and wires of the various companies and authorities using them. The Commissioners remark that, assuming the subways are of sufficient size, this remedy would prove effective; but the cost would, they say, be so great as to prove in many cases prohibitive. They acknowledge that subways could be constructed with advantage when new streets

were being built or old ones widened, or on the occurrence of any other favourable opportunity; but they confess that "the remedy is not one that can be applied generally." At present the rights and obligations of the different parties who have statutory powers to open the streets are not the same in all cases; and the Commissioners consider that the diversity tends to produce "confusion and difficulty." A Bill dealing with the subject was promoted by the Corporation of the City of London in 1902, as noticed in the "JOURNAL" at the time; and the recommendations the Commissioners have to make in this respect are substantially in agreement with the provisions of that measure. The Commissioners consider that the statutory rights and obligations of the various companies should, as far as possible, be made uniform; that the indiscriminate breaking up of the streets should be prohibited; that new service mains should be laid under the footpaths; and that, in according sanction for the opening of streets, regard should be had to the effect of similar operations which may be carried out at the same time in adjoining districts, and the simultaneous interference with parallel streets affording alternative routes avoided. In order to carry out these recommendations, fresh legislation would, of course, be required; and the Commissioners suggest that advantage should be taken of its initiation to clear up certain misunderstandings which exist in regard to the powers possessed by the Corporation of London under the Sewers Act, 1848. The Commissioners call attention to the fact that in many of the streets of London so many pipes, wires, and public service works have been laid beneath the surface, that the question of the exercise of supervision, by some public authority, over the laying of new pipes is becoming one of importance. They think power should be given to the street authorities to require the owners of all dead mains to remove them, if necessary, when laying new ones; and they suggest that plans should be provided, open to inspection by the public, showing all wires, pipes, and other similar works, under each street. The Commissioners recognize that these matters have already been dealt with to some extent; but what is now required is, in their opinion, the introduction of a "definite system dealing in a complete manner with the whole subject."

With regard to the constitution of the proposed Board, the Commissioners consider that it should consist of a chairman and not more than four nor less than two other members; and they prefer that there should be not more than three members in all, if it is found that they can satisfactorily discharge all the duties assigned to them. No member of the Board should engage in any business or have any interests which might conflict, or appear to conflict, with the proper discharge of his official duties; nor should he be a member of any local authority in London, or have any occupation which would limit the time he could devote to the work of the Board. As efficiency is indispensable, the members of the Board should be specially selected by the Government, and be paid such salaries as would be sufficient to secure thoroughly competent men. It has been suggested that one member should be a lawyer and another an engineer. But the Commissioners prefer that the choice of the Government should be unfettered by any statutory restrictions. What appears to be really essential is that the members of the Board should be capable men of business, energetic, impartial, and able to devote, if necessary, their whole time to the work entrusted to them. The Board would keep in touch with all the local and other authorities in Greater London, and maintain a "friendly attitude" towards them and all companies and persons working railways, tramways, or other means for facilitating locomotion and transport. The Commissioners think that the cost of the Board, with that of its establishment, in excess of the fees levied in connection with it, should be raised rateably from the local areas within its jurisdiction.

The report is not a unanimous one. Though Sir Joseph Dimsdale has signed it, he has, in a supplementary report, stated his views on certain subjects in regard to which he is not in agreement with the majority of the members of the Commission. His opinion is that they should have issued an interim report, dealing shortly with the existing difficulties, and suggesting the formation of an improvements advisory tribunal before whom could be laid the report of the Advisory Board of Engineers. He counsels "going by stages" in this matter. He points out that the ratepayers are already over-burdened; and, as trade is anything but buoyant at the present time, they may with good reason be alarmed at the prospect of improvements involving so huge an outlay as that contemplated by the Board. The report is not signed by Sir George Bartley, for the reasons stated in a separate report. He agrees with the formation of a Traffic Board mainly on the lines of the report; but he does not approve of the action of the Commissioners in forming an Advisory Board of Engineers, nor does he consider that the Commission are in a position either to accept or reject their recommendations. On the question of opening the streets, Sir George fears that the regulations suggested would be more easily carried out in theory than in practice. With the creation of new broad avenues, however, provided with subways, space would be afforded for pipes and wires, and the inconvenience caused by breaking up the roadway avoided. Sir George agrees that the proposed Traffic Board should investigate all schemes for locomotion in London, and report on them to Parliament; also that the Board should regard all proposals as part of "one whole general and harmonious scheme for the entire area of Greater London."

PERSONAL.

Mr. JAMES PATERSON, M.A., who was selected in 1903 to succeed Mr. Douglas H. Helps as Engineer and Manager of the Redhill Gas Company, has now been appointed by the Board to the joint office of Engineer and Secretary; the latter position having been vacated by Mr. Charles Read, after a lengthy term of service.

Mr. JOHN MACKENZIE, lately in the service of the Hastings and St. Leonards Gas Company, has been appointed Engineer to the Newcastle (New South Wales) Gas Company; and he will shortly leave England to take up his duties. Mr. Mackenzie received his early training under his father at the Dunfermline Gas-Works, and was subsequently engaged at the Dawsholm Gas-Works, Glasgow, and the Middlesbrough Gas-Works.

At the meeting of the Metropolitan Water Board last Friday, Dr. A. C. HOUSTON was appointed Director of Water Examinations, at a salary of £1000 per annum. On the same occasion, the office so long held by Sir WILLIAM CROOKES and Professor DEWAR, in connection with the examination of water supplied to the Metropolis, was abolished. Dr. Houston's name has been frequently mentioned in the "JOURNAL" in association with his bacteriological researches.

Last Tuesday, Mr. W. J. SUMNER, who has been the Ilford Gas Company's Inspector of mains and services, and has held various other offices, for the past twelve years, having been appointed Manager of the Walton-on-Naze Gas Company, was presented by the Engineer and Manager (Mr. A. A. Johnston) with a purse of money, as a token of the esteem and regard in which he is held by the staff and workmen of the Company. In making the presentation, Mr. Johnston said he was quite sure Mr. Sumner would be successful in his new sphere, as he had been at Ilford. In reply, Mr. Sumner thanked all very much for their present and kind wishes, and said he would purchase something as a memento of his connection with Ilford, though he did not think he would need much to remind him of the place and its associations. In the course of his remarks, Mr. Sumner acknowledged that the men in the service of the Company were, as a whole, such as could not easily be beaten; and Mr. Johnston remarked that their efforts and good behaviour were appreciated by the Directors and staff. Before the presentation was made, a photograph of the staff and workmen was taken, and a copy will be handed to Mr. Sumner as a further memento of Ilford.

THE GAS STOCK AND SHARE MARKET.

(For Stock and Share List, see p. 265.)

BUSINESS last week on the Stock Exchange was quiet throughout; the attendance being light at the opening, and again tailing away towards the finish, in view of the Exchange being closed on Saturday. The tendency too was adverse, almost all departments (from the Consols Market downwards) showing easier prices; but there was no sharp fall. The Government defeat on Thursday made things flatter at the close. The Money Market was extremely easy, the supply being overabundant; and deposit rates were lowered. Discount was rather inclined to fluctuate, but closed easy. Business in the Gas Market was rather quiet in the aggregate, although one or two of the chief issues were active enough. The tendency was still bright and firm; and although very few changes in quotation were made, they were all in the upward direction. In Gaslight and Coke issues, the ordinary engrossed almost as much attention as all the rest of the list put together, and changed hands at steady figures ranging from 99 to 100½—the best prices being towards the end. Beyond this, no effect seems to be produced by the announcement of the rate of dividend. This will be at £4 8s. per cent., the same as before; but it will take about £30,000 out of the carry-forward to pay it. This result of the half-year's working is not so bad when it is remembered that we practically had next to no wintry weather when it was due, and that the markets for residual products have been (and still are, for the matter of that) very disappointing. A good many other companies will probably show a rather "lean" half year. The secured issues were quiet; the maximum marking 92¼, the preference 109½ and 110, and the debenture 88½. South Metropolitan was active and on the rise. Transactions ranged from 130 to 132; the quotation advancing two points. The debenture was done at 89¾. In Commercials, there were dealings in the 4 per cent. at 118¼ and 118¾, and one in the 3½ per cent. at 113½. Even less than usual was done in the Suburban and Provincial group. Bromley "A" marked 120½, and ditto "B" 90½. South Suburban preference made 128½ and 129, West Ham ordinary from 103 to 104, and ditto preference 125. The Continental Companies showed a much reduced scale of activity. There were a few dealings in Imperial at from 211 to 212½; but nothing was marked in either European or Union. The general quietude affected the undertakings in the remoter world, which were not much noticed. Cape Town changed hands at 17⅛, Primitiva ordinary at 5⅝ and 5⅞, and ditto preference at from 5¼ to 5 1/16, with a fractional advance in the quotation. River Plate was done a few times at figures ranging from 12⅛ to 12¼, also improving its quotation. Hong Kong had a rise of half-a-point, but no transaction was marked in it.

THE ACTION OF GASES UPON FIRE-BRICKS.

By Thomas Holgate, F.C.S., M.Inst.C.E.

(*Concluded from p.* 171.)

It is evident from the description with which last week's article ended that the carbon coating at the hearth of the blast-furnace is akin to the carbon deposited in close structure upon the inside of gas-retorts; while that deposited in the upper zones of the furnace is akin to that found in carburetted water-gas superheaters and carburettors. The reason for the phenomena is made clear by the exact study of the reactions which take place between carbon, carbon oxides, iron, and iron oxides at gradually increasing temperatures; but before stating these recent researches further reference to working conditions and deposits of dust and carbon in water-gas plant must be made.

Practical Working of Carburetted Water-Gas Carburettors and Superheaters.

The experience, previously referred to by the writer, which resulted in the disintregation of a certain percentage of the bricks near the oil injector of the carburettor and at the top of the superheater was probably magnified by the fact that only one unit was available. As a consequence, it was not possible to stop and clean off the bricks so frequently as is found to be desirable for the removal of deposited carbon or dust from the fuel. The circumstances were probably unusual in the high percentage of oxide of iron in the ash of the coke, which, being drawn from seams of coal in strata contiguous to iron ore, was of a distinctly reddish colour.

The crude uncarburetted water gas, consisting approximately of 46 per cent. of carbon monoxide and 48 per cent. of hydrogen, is a powerful reducing agent through a wide range of temperature. Herr F. Glaser has recently shown that hydrogen is capable of reducing ferric oxide (Fe_2O_3) to magnetic oxide (Fe_3O_4) at 298° C., to ferrous oxide (FeO) at 305° C., and to metallic iron at 495° to 500° C.—temperatures which are regularly exceeded in both carburettor and superheater. Mr. J. P. Leather's diagram from an electrical recording pyrometer showed 1075° Fahr. minimum to 1160° Fahr. maximum,* equivalent to 580° to 627° C. respectively. This reading was at an intermediate point in the height of the superheater, and probably the top of the apparatus would be cooler.

Not only is hydrogen effective in reducing the oxides of iron, but M. Georges Charpy has just shown that steel or iron heated in contact with illuminating gas causes carbon deposition in measurable quantity from the hydrocarbons; and this is effected in a greater degree by cyanogen gas.

Soon after the introduction of carburetted water-gas plants into this country, it was the practice to place blocks of iron in lieu of bricks under the oil injector, with the hope of prolonging the life of the chequer work. But the remedy was found to be worse than the disease, and it was quickly abandoned. In the light of the reactions between iron and the various gases, it is not unreasonable to suppose that these played an important part in the running of the metal—at least accentuating the effects of the temperature. The alternate oxidation by the "blow" gases and the deoxidation by the hydrogen and carbon monoxide would keep the surface of the metal in a rapid state of change, and facilitate fusion.

Analyses of Bricks from Water-Gas Carburettor and Superheater.

Constituents.	A. Original Fire-Brick.	B. From Interior of a Used Fire-Clay Block.	C. Brick from Under Oil Injector.	D. Brick from Top of Superheater.	C^{I}. Inside of the Brick C.	C^{II}. Outside of the Brick C.
Silica	63·62	64·20	62·06	67·50	..	..
Alumina	26·24	29·97	27·65	22·39	..	..
Total	89·86	94·17	89·71	89·89	..	..
Oxides of Iron	6·84	3·43	7·67	6·37	7·32	14·75
,, manganese	0·08	*nil*	trace	0·44	..	..
Lime	1·28	0·80	1·00	1·55	..	..
Magnesia	0·10	trace	trace	trace	..	..
Soda and potash	1·84	1·60	1·62	1·80	..	..
Alkalies and Alkaline earths	3·22	2·40	2·62	3·35	..	..
Do. do. with iron and manganese	10·14	5·83	10·29	10·16	..	..
Total accounted for	100·00	100·00	100·00	100·05	..	..

Notes.—Brick C. was cracked, and broke readily when pressure was applied. The texture was rough, the surfaces being covered with oxide of iron nearly 1-16th inch thick. This outside portion was tested as C^{II}; while the inside was tested as C^{I}. D appeared black and fused throughout. The part tested was from the interior of the brick. The exterior was honeycombed by the fluxing action of the original and deposited constituents.

* See "Journal," Vol. LXXVII., pp. 1208-9.

It would appear that the deposition of "lampblack" in the carburettor and superheater, which every gas engineer is so anxious to avoid, may proceed from two causes—(*a*) excessive heating of the oil by unduly high temperatures of the chequer-work; and (*b*) an undesirable decomposition of carbon monoxide and hydrocarbons by iron in the metallic state or in that of its oxides either in the bricks or deposited in dust thereon. Coincident therewith may be a loss of hydrogen caused by deoxidation of iron with formation of water vapour. In the foregoing table, A and B are specimens of the original brickwork in the carburettor and superheater, and the other analyses are of the materials after use.

A and B, presumably from the same source, differ considerably in percentage of iron. The state of oxidation of the iron was not recorded, nor the percentage of carbon in the bricks; but the dust upon them contained the following: Carbon, 94·1; ash, consisting of Fe_2O_3 with trace of lime, 5·9 per cent.; and in another sample 83 per cent. of carbon. This was a composition very similar to that found in the carbon deposit of the Cleveland blast-furnace. The greater part of the deposit was at the top of the superheater, normally the coolest portion. The apparent accession of oxide of manganese in D is worth noting in view of Guntz's experiments hereafter mentioned. Subsequently the use of bricks containing only about 1 per cent. of oxide of iron resulted in a marked diminution in the carbon deposit and disintegration of the bricks. It is a fact worth noting also that when the brickwork was encrusted with these deposits the illuminating results from the oil were not so good as with clean chequer-work. It is therefore desirable that means should be employed for intercepting the dust from the generator, and for frequent "burning-out" of the chequer-work, with periodical brushing or other cleaning of the bricks.

In the case of a different type of carburetted water-gas plant from the one just mentioned, the following is the experience of the engineer after a number of years' working. He says: "We find the life of the bricks in the carburettor is about 16 weeks' constant use. The bricks are then taken out and cleaned, when we find about 25 per cent. are useless. The remainder of the bricks, after being cleaned, are replaced in the carburettor, and supplemented with bricks that have been used in the superheater. The life of the bricks in the superheater is about twelve months' constant working. The bricks are then removed, and some, after being cleaned, are placed in the carburettor; their place being taken by new bricks in the superheater." The fact that 25 per cent. in the carburettor are useless after 16 weeks' work points to a very real disintegration; and their systematic removal at these short intervals no doubt conduces to the satisfactory working of the plant year by year at the large gas-works in question.

Temperature and Conditions of the Reactions.

Many able investigators have been engaged in finding the details of the actions outlined by the late Sir Lowthian Bell from his experience of practical operations, and it will be impossible, for lack of space, to refer to each of them; but the review of Guntz in connection with his own original work concentrates the results of most importance, some of which have since been confirmed and amplified.

Stammer found that on passing carbon monoxide over oxide of iron heated to a temperature below the softening point of glass, a considerable quantity of carbon in a bulky state was obtained as well as metallic iron. Deville recorded the fact that when iron is heated in carbon monoxide, a deposit of carbon is formed upon the cooler parts, while those which are hotter are unaffected. This fact is explained by the heat evolved by the reaction $Fe + CO = FeO + C$ decreasing as the temperature rises and disappears or becomes negative at high temperatures. Failure to accept this view is due to the erroneous assumption that a substance stable at high temperatures is similarly resistant to chemical action.

Thus carbon monoxide is very stable at high temperatures, but it is easily decomposed by oxidizable bodies, as its heat of formation is low, 14·4 calories, which is a quantity of the same order of magnitude as that of mercuric oxide—viz., 15·5 calories. The reason why carbon monoxide is less vigorous an *oxidant* than mercuric oxide is that, on account of its stability, it is not dissociated when heated, and therefore needs the expenditure of work upon it to start its *reducing* action. If the metal to be oxidized is obtained in a sufficiently fine state of division, the reaction is much aided. Manganese, for example, burns easily in carbon monoxide when once the oxidation is started.

The oxidizing action of carbon monoxide occurs at temperatures ranging between 100° and 400° C., and its reducing action from 300° C. to a red heat; the molecular state of the metal acted upon and its chemical activity determining the precise limits. Examples of both kinds of reaction are afforded by iron. When carbon monoxide, at the ordinary temperature, is passed over iron electrotytically prepared, iron carbonyl is formed in sufficient quantity to give a mirror-like ring of metallic iron, which is considerably more marked than that formed when iron reduced from the oxalate is used. On raising the temperature to 150°—160° C., a part of the gas is absorbed, with the formation of ferrous oxide and carbon ($Fe + CO = FeO + C$).

When heating is effected rapidly to about 300° C., carbon monoxide is at first absorbed almost completely, but afterwards, as the reaction diminishes, carbon dioxide is produced in small quantity, as a product of the reduction of oxide of iron by carbon monoxide. The reduction is never complete, as the action is reversible. Iron reduced from the oxalate or oxide gives the same reaction, but more feebly, its inertness increasing with the temperature at which it was originally reduced. Mechanically comminuted iron will behave similarly, though still less vigorously. Thus in one zone of the blast-furnace spongy iron comes

in contact with CO, yielding FeO and carbon; in another zone this FeO is reduced by CO, giving spongy iron and CO_2; finally, on reaching a zone of higher temperature, the finely divided iron and carbon unite to form carburetted iron."

As the analyses of the bricks given by Mr. Firmstone and Mr. Pattinson make no reference to oxides of manganese—which, however, may have been included in iron—and as two of the samples of the bricks used in the water-gas plant show a distinct percentage and in two others a trace, the following experiments by Guntz will be of importance. Using pure metals, he found, when subjected to the action of carbon monoxide, that with iron, carbon began to separate when a dull red heat was attained; a very small quantity of carbon dioxide was formed, and at the same time the iron seemed to absorb carbon monoxide.

More satisfactory results were obtained with manganese. The metal was heated at about 400° C. in a glass tube, through which a current of carbon monoxide was passed. It was thus found that after a while action begins between the manganese and the gas, and heating may be discontinued, as it proceeds with such vigour as to render the mass incandescent, and cause a partial vacuum in the apparatus. The carbon monoxide is totally absorbed; the products being manganous oxide (MnO) and carbon, no carbon dioxide being formed. This is analagous to the reaction for iron ($Fe + CO = FeO + C$). But its greater completeness is accounted for by the resistance of the oxide of manganese to reduction by carbon monoxide at all temperatures; and in this it differs from iron. This view is also confirmed by the readiness with which manganese burns in carbon dioxide, and by the identity of the products with those which are formed when it is burnt in the monoxide. At high temperatures the suboxides of iron and manganese, when heated with carbon, give the metal and carbon monoxide—that is to say, the action is the reverse of that taking place at about 500° C.

In this connection it is instructive to compare the effect of hydrogen on manganese oxides; the higher oxides being reduced at low temperatures, but the manganous oxide only at a high temperature as follows: MnO_2 is reduced to Mn_2O_3 at 183° C., to Mn_3O_4 at 230° C., to MnO at 296° C., and to manganese (metal) above 1200° C. These are the determinations made by Glaser, and lead us to expect that the hydrogen of the water gas in a carburettor or superheater will reduce the manganese oxides to the lowest form (MnO), which in turn, as shown by Guntz, is capable of being reduced at high temperatures by carbon monoxide, and at 1200° C. by hydrogen to the metallic state, in which condition at a lower temperature it is active in promoting carbon deposition.

The calorific effects of the various reactions between the oxides of carbon and iron or its oxides shows which have the greatest tendency to take place. Thus—

(1) $Fe_2O_3 + 3\,CO$	$= Fe_2 + 3\,CO_2$.	
189·86 + 3 (29) cal.	= 3 (96·96) cal.	
276·86 + x	= 290·88	$x = +$ 14·02 cal.
(2) $Fe + CO$	$= FeO + C$	
x + 29 cal.	= 75·94	$x = +$ 46·94 cal.
(3) $CO_2 + C$	= 2 CO	
96·96 + x	= 58	$x = -$ 38·96 cal.

The first two are seen to be exothermic, and the second one, intimately connected with carbon deposition, has the higher value; while the last is endothermic. It is the inverse action of No. 3 that concerns the question under consideration when x becomes exothermic, and + 38·96 almost equal to No. 2, and being similar in causing carbon deposition.

Thus $CO = CO_2 + C$.
$58 + x = 96{\cdot}96$.
$x = +\,38{\cdot}96$.

The temperatures at which the actions commence have been determined by Sabatier and Senderens for iron, nickel, and cobalt, when heated in the presence of carbon monoxide. Below 100° C., iron carbonyl ($Fe\,[CO]_5$) is formed. From 100° to 200° C. there is no reaction; towards 330° C. the reaction $Fe + CO = FeO + C$ begins; and above 400° C. carbon dioxide appears from the reaction $FeO + CO = Fe + CO_2$. Up to 450° C. both of these reactions increase in rapidity; but the first is always the chief. As, however, at this temperature iron has no action on carbon dioxide, iron heated in a closed vessel with a limited amount of carbon monoxide ultimately converts the whole of it into carbon and the dioxide.

The experiments of M. Georges Charpy continue the ascent in the scale of temperatures, as the following figures show. Heating steel in a slow current of carbon monoxide, he found up to 715° C. a deposit of pulverulent carbon, and at 825° and upwards no deposit of it, but carburizing of the metal by the absorption of the carbon from the decomposed monoxide.

Temperature. Degrees C.	No. of Hours Heated.	Carbon Absorbed by the Metal, per Cent.		
		From Increase in Weight.	From the Combustion of the Metal.	From the Weight of CO_2 Formed.
560	8	0·10	0 09	Deposit of carbon.
600	8	0·22	0·17	,, ,, ,,
715	8	0·26	0·28	,, ,, ,,
825	3	0·56	0·57	0·60 per cent.
1025	2½	0·60	0·58	0·58 ,, ,,
1190	2	0·30	0·36	0·33 ,, ,,

When steel filings containing 2 per cent. of carbon were heated in pure carbon monoxide, it contained in one sample 3·27 per cent. of carbon after heating for two hours at 900° C., and another sample for four hours, at the same temperature, 4·90 per cent. of carbon; while a third, heated to 1000° C. for 1½ hours, contained 2·66 per cent. of carbon, which prolonged to 36 hours contained 9·27 per cent., of which 8·27 per cent. was in the form of graphitic carbon. Similarly, a piece of soft steel containing 0·09 per cent. of carbon, maintained at 1000° C. for 64 hours in illuminating gas, contained 8·32 per cent., of which 7·66 per cent. was in the graphitic form. Carburizing of iron wire began at 925° C. in illuminating gas, and at 850° C. in cyanogen gas. In the former, after five hours' treatment, there was 0·15 per cent. of carbon, and in the latter in half-an-hour, at 850° C., there was 0·55 per cent.; while at 990° C. for two hours there was 4·32 per cent.

Final Considerations.

It is probable that the accession of manganese in the brick from the water-gas plant may be due to the metal contained in the ash of the coal, since the iron ores in the neighbourhood contain it. It may, however, be due to the variations of the original fire-clay, as the districts from which it came likewise have manganese in their fire-clay and seams of iron ore.

While the cause of the disintegration of fire-brick by gases has received considerable elucidation, and it has been shown how the trouble may be minimized or avoided in large measure by keeping out iron, manganese, and their oxides, yet there are opened up many problems that will repay consideration and observation on the part of those controlling carburetted water-gas plants.

CHECKING ELECTROLYSIS IN LOS ANGELES.

We learn from "Engineering Record" that the Water Department in Los Angeles (Cal.) and the Los Angeles Railway Company have made a combined attempt to prevent the electrolysis of the cast-iron mains in the city water-works by return current from electric street railways. It was found that bonding the mains to the rails protected the service connections, but caused corrosion at the joints in the mains. It was considered that, if all the joints were of insulating material, the main would be self-protecting, as there would not be sufficient difference of potential at the individual joints to cause current to flow round, either through the water in the pipe or through the earth outside, unless the latter were unusually acid. The difference in potential between the pipe and the rail could thus be materially reduced according to a statement by Mr. E. F. Scattergood in the "Sibley Journal of Engineering" (the student's journal of the Cornell University), in dealing with the experiments made. He says: The resistance of the pipe line compared with the path through the earth from pipe to rail and from rail to pipe, would be increased in this manner, and, if necessary, the pipes could be protected by bonding the mains to the rails.

A length of 752 feet of 6-inch cast-iron pipe was laid with cement joints in a street leading from one on which the railway power-house is located. It was continued with 692 feet of the same pipe with the usual lead joints, and was laid within a foot of an old main, and covered with moist earth, but without any metallic connections. The pipe was then filled with water, and the two sections bonded together. The end near the power-house was also bonded to the rail of the tracks in the street above it, and the opposite end was bonded to the rail at that point. Tests made to determine the results showed that, in approaching the power-house, there was a drop of 1¼ volts in each 100 feet of the section with cement joints, and but 1 to 3 ampéres current flowing in the bond at the power-house end, which probably leaked from the old main to the end section of the new one. The 1¼-volt drop per 100 feet is twice that found in any of the rails in the city; and the difference in potential between the ends of the section with the cement joints, Mr. Scattergood says, was evidently equal to a rail drop of double the distance *plus* the drop in the lead-joint section due to reverse current in it. The leaded section was tested at the same time, and the current flowing in it was found to be 40 ampéres. This flowed to the bond with the rail at the distant end of the section, and then back through the rail to the power-house. The centre bond joining the sections of the main with different types of joints was afterwards connected through a resistance to the trolley wire. Tests made showed 120 ampéres flowing in the lead-joint section, but only the same 1 to 3 ampéres in the bond at the end of the cement-joint section near the power-house, though the tendency was in that direction.

The late Mr. James Mansergh, whose death was recorded in the "Journal" for the 20th ult., left estate of the gross value of £103,641. The estate of Earl Stanhope, who was a Director of the Kent Water Company, has been valued at £115,691 gross. Mr. John Edwards, of Mold, a Director of the Mold Gas and Water Company, left £9790.

THE DUTCH ASSOCIATION OF GAS MANAGERS.

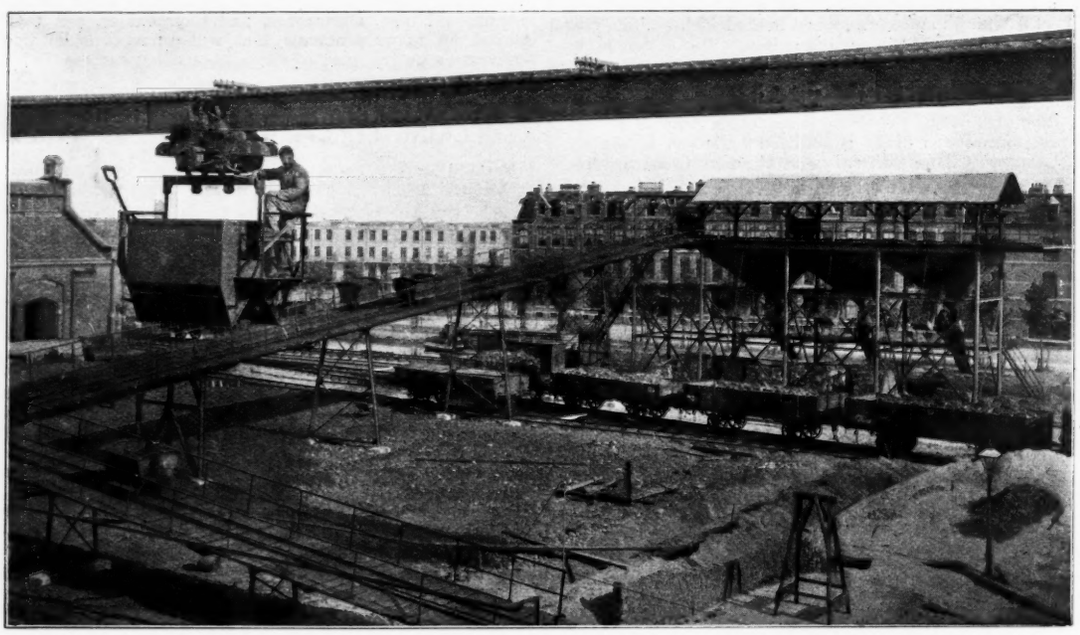
Thirty-Third Annual Meeting—Amsterdam, July 11 to 13.

At the "Tolhuis," beautifully situated on the other side of the "Y" (an arm of the Zuider Zee), near the Central Railway Station, the members and guests of the Association were received on the evening of Monday, the 10th inst., by the well-known President, Heer J. W. H. Bauduin, the Director of Public Works at Maastricht, and the other officials.

On Tuesday morning, at nine o'clock, the meeting was opened in the Bellevue Buildings, the walls of the hall being covered by plans, drawings, &c., of the two gas-works at Amsterdam. On one side there was also a small exhibition by Messrs. Elster and Co., who are the representatives in Holland of Messrs. S. Cutler and Sons; while the Dordrecht Gas-Meter Company had fitted up some incandescent burners, which were automatically lighted from a distant point by means of an appliance the invention of Heer Bauduin. At one o'clock the proceedings were suspended for lunch, after which the technical business was continued until about four o'clock, when the members were conveyed by special electric trams to the Zoological Garden, where dinner was served.

On Wednesday the meeting opened at the same hour, and the business was resumed. After luncheon, the members had a steamer trip at Zaandam, the place where Peter the Great lived and worked. The visitors were cordially received by the acting Mayor of the town, Heer P. Latenstein, and by Heer G. J. Wolters, the Director of the Municipal Gas-Works. These and the "Czar Peter House" were visited; and after a short rest at the Clubhouse of the Trouw aan Verbentenissen, the party returned to Amsterdam. In the evening there was a banquet at the Bible Hotel, attended by upwards of 150 members and friends.

On Thursday morning, a visit was first paid to the West Gas-Works, an interesting incident in connection with which being a luncheon served under the large gasholder, described and illustrated in the "JOURNAL" for the 11th inst. At this function there was present, as evidence of his interest in the meeting, Heer Th. Heemskerk, one of the aldermen of Amsterdam, and the President of the Municipal Industrial Undertakings, who made a very appropriate speech, dealing with the social and financial side of the municipal gas industry and the relations between the Municipality and the officials at the gas-works—paying a high compliment to Heer D. van der Horst, the General Manager of the works, and the technical and commercial staff acting under him. From these works the visitors were conveyed by special train to the East Works, where the great attractions were the new carburetted water-gas plant erected by Messrs. Cutler and Sons (illustrations of which appear elsewhere), and a "Rotary" meter



MECHANICAL COKE-TRANSPORT ARRANGEMENT AT THE EASTERN GAS-WORKS, AMSTERDAM.

having a capacity of 30,000 cubic feet per hour. The features of the carburetted water-gas plant were pointed out by Mr. S. Cutler, jun.; and Mr. T. G. Marsh gave particulars of the working of the meter. Much interest was also shown in the manufacture of incandescent mantles, the production of which amounts to 1000 to 1200 per diem. At the close of the visit, Heer J. van Rossum du Chattel, the Manager, held a reception in his beautiful garden.

As a *souvenir* of the meeting, the Municipal Gas Department presented to all who attended it a collection of 24 photographs of both works, thus furnishing a permanent record of a gathering which left the most agreeable remembrances of the hospitality enjoyed by the members and their friends at Amsterdam.

The Business Meetings.

As already mentioned, the proceedings were opened on the morning of Tuesday, the 11th inst., under the presidency of Heer J. W. H. Bauduin; the vice-chair being occupied by Heer J. Blom. The following officials were present: Heeren N. W. van Doesburgh (Secretary), P. Bolsius (Assistant-Secretary), H. R. de Breuk (Treasurer), J. van Rossum du Chattel (Vice-Treasurer), and D. J. Cramer (Member of the Committee). Heer D. van der Horst, the General Manager of the Amsterdam Gas-Works, who is an honorary member, and many members and visitors, were also present. Among the associate members were Mr. S. Cutler, jun., of London, and Mr. T. G. Marsh, of Manchester.

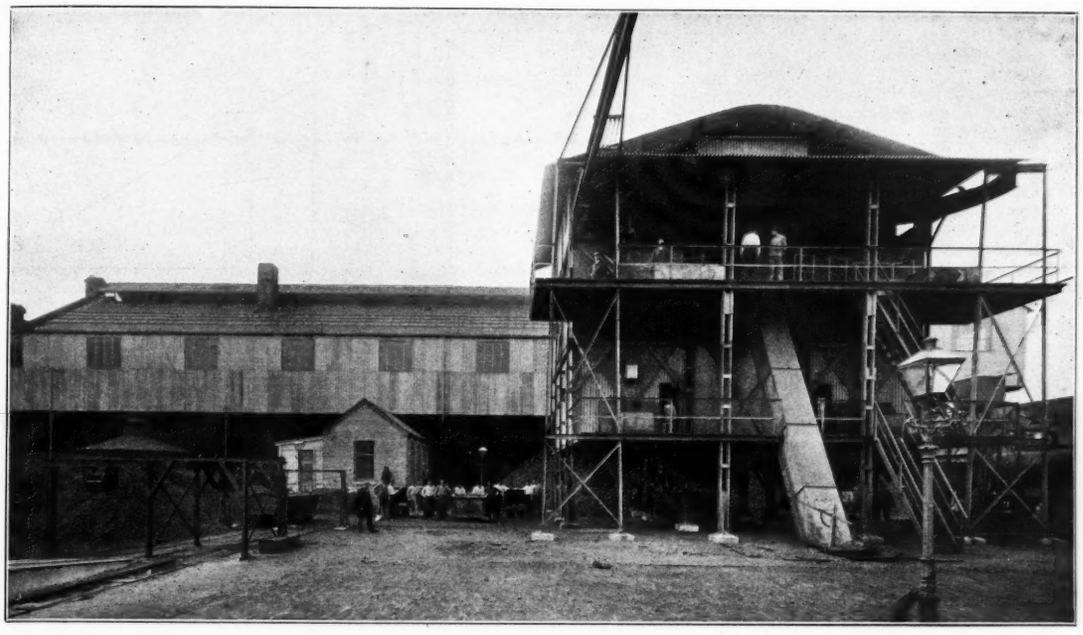
After offering a few words of welcome to the new members and guests, and especially to Heer van der Horst, and making suitable reference to the three deceased members—Mr. E. Drory and Heeren S. Kenens and L. Ketjen—the President reviewed the work of the Association during the past year; mentioning particularly the International Gas Exhibition at Earl's Court. He also referred to the 25 years' existence of "Het Gas," the official periodical of the Association—an event which had been celebrated, in the presence of many members, on the 29th of the preceding month. He went on to say that, with the development of the gas industry, the growth of the Association fully accorded; the number of members having increased to 340, ordinary and extraordinary, among whom were three honorary members. As the outcome of a proposal emanating from many of their colleagues, a fourth honorary member had been appointed—Heer C. T. Salomons, who, since the first publication of "Het Gas," had been one of its Editors, and, as was unanimously and heartily confessed in Holland, its *nervus rerum*. Heer Salomons at this point entered the hall, and received an enthusiastic ovation.

The first portion of the proceedings was occupied with the reading of reports of various Committees (furnishing particulars as to membership, financial matters, &c.) and the usual preliminaries. Heer Salomons and Heer Bolsius were unanimously re-elected Editors of "Het Gas;" and the following were chosen as office-bearers for the current year: President, Heer J. van Rossum du Chattel; Vice-President, Heer J. W. H. Bauduin; Secretary, Heer N. W. van Doesburgh. Heer O. S. Knottnerus was appointed a member of the General Committee; and Heer J. W. van Oostrom Meyjes a member of the Relief Fund Committee.

These matters having been disposed of, the technical business was commenced with the consideration of communications on

THE GAS SUPPLY OF AMSTERDAM.

Heer van der Horst expressed his hearty thanks for the highly appreciated distinction the meeting had conferred upon him by

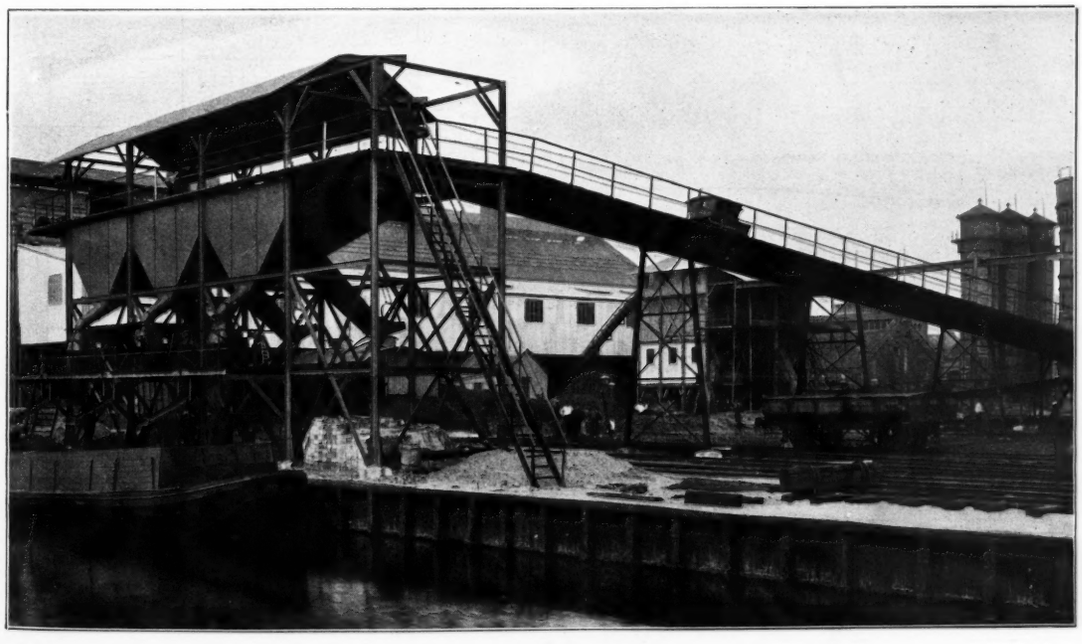


From the Works Side.

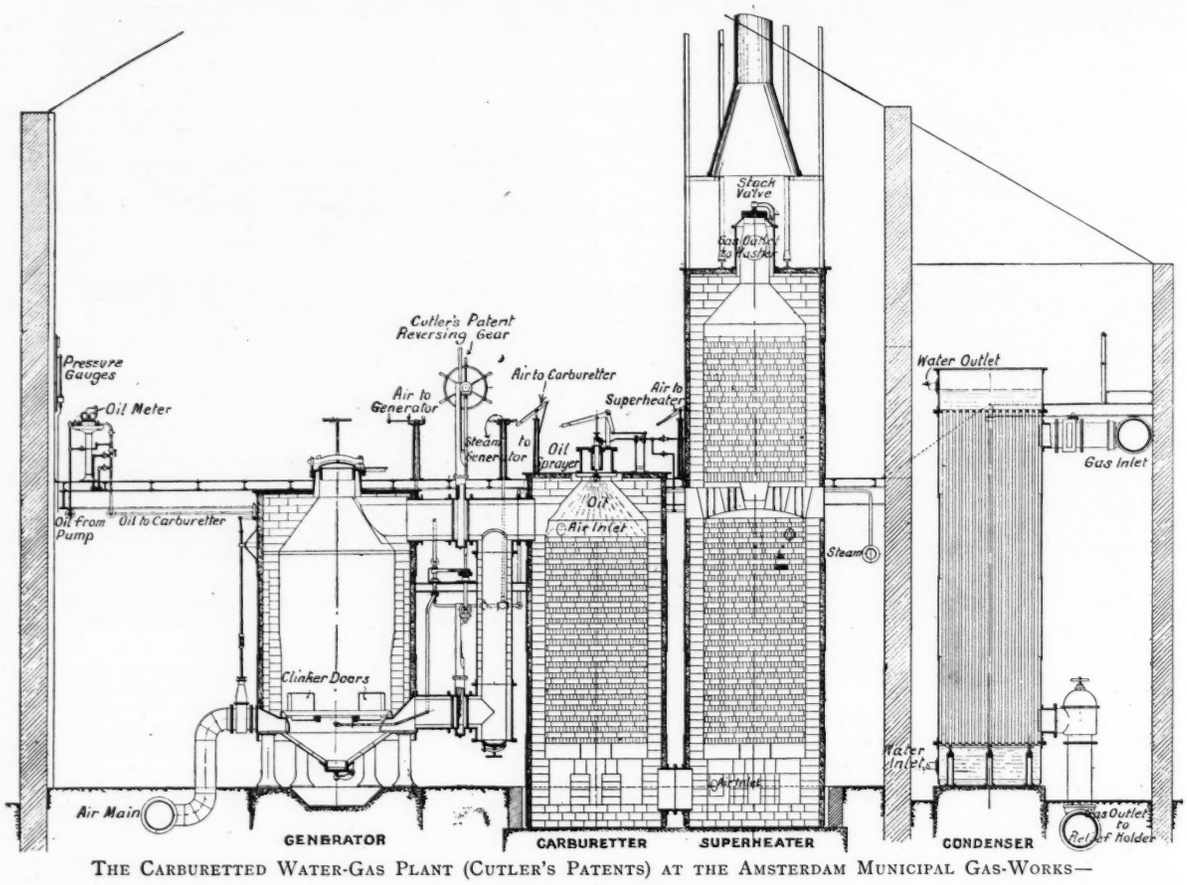
electing him an honorary member at the meeting last year, at which he was unable to be present owing to illness, and for the interest that had been shown in his recovery. He then reviewed the progress of the gas-works from 1898 to the present year—the period in which they have been under municipal management. Starting with a production of 31 million cubic metres (1095 million cubic feet), and a working capital of 17 million guilders, they had increased to 62 million cubic metres (about 2200 millions) and a capital of 19 million guilders only; so that they had doubled the production with an increase of only 2 million guilders in the capital. The reason of the large increase was, in the first place, the lowering of the price from 9 c. to 7 c. per cubic metre; next, the growth of the population; and last, but not least, the energetic way in which the prepayment system had been carried through. This showed that there had been hard work by the entire staff. By the aid of drawings, the development of the gas supply of the city was illustrated, and the general organization of the service was shown. The speaker said there had been a great aspiration on the part of all to reach perfection, and strong support had been given by the Administration, who had cordially co-operated with the Gas Department in effecting improvements in the service. Theory and practice had been effectively combined, and the best results had been attained in consequence.

The Hydraulic Plant at the East Works.

The next communication was by Heer J. van Rossum du Chattel, on the above subject; and it was well illustrated by drawings. This plant is used for working two lifts, each of a capacity of 30,000 kilos., raising the coal-trucks from the ground floor to the viaducts in the retort-house, 23 feet above the yard level (the pressure required being 50 atmospheres); and for driving the Arrol-Foulis charging and discharging machines, of which eight sets are at work. This plant, which was erected by the Nederlandsche Fabriek van Werktuigen en Spoorwegmaterieel at Amsterdam, consists of two high-pressure engines, equal to pumping 120 gallons per minute against a pressure of 50 atmospheres. They are provided with injector condensers, and work at a speed of only 60 revolutions per minute. The high-pressure pumps are differential, also double suction and double forcing. The diameter of the ram is 12 inches, and that of each of the two accumulators about 8 feet, and the height 12 feet; their load being 28 tons. For the charging and drawing machinery, the



From the River Side.



THE CARBURETTED WATER-GAS PLANT (CUTLER'S PATENTS) AT THE AMSTERDAM MUNICIPAL GAS-WORKS—EASTERN STATION.

pressure is reduced to 30 atmospheres in an accumulator of the old hydraulic plant. The old English hydraulic pumps have been altered so as to lift 120 gallons per minute against a pressure of 30 atmospheres, instead of 80 gallons against 50 atmospheres. They only work the retort-house engines, instead of serving for the lifts as well. If needed, however, the new machinery could take over their work, so that in reality a four-fold security is obtained. This is not a mere luxury, for slight accidents, such as the breaking of water-pipes, &c., have at times stopped the machinery in the retort-house or the lifts; and as no skilled workmen capable of charging the retorts in the old way were at hand, this led to many difficulties. The financial results obtained by the mechanical charging and drawing of the retorts are not unfavourable, as will be clearly seen from the following figures, showing the costs (in florins) of labour per metric ton (1000 kilos.) of coal distilled in both works:—

	West Works. (Manual Labour.)	East Works. (Mechanical Stoking.)
1901	1·48⁴	1·17⁹
1902	1·54⁶	1·17⁵
1903	1·59⁴	1·20⁵
1904	1·41⁶	1·04⁴

West Works.	East Works.	West Works. Amount.	West Works. Per 1000 Cub. Met. of Gas.	East Works. Amount.	East Works. Per 1000 Cub. Met. of Gas.
		£247 11 10		*£273 10 0*	
457,130 c.m. = 16,039,000 c.ft.	445,226 c.m. = 15,724,000 c.ft.	2,971·08	6·543	3,282·00	7·364
Production 318,330 kilos. = 313 tons 12 cwt. coke.	295,380 kilos. = 291 tons coke.	*£73 6 8* 880·02	1·938	*£40 19 0* 491·44	1·102
For steam production: Small coke, coke dust		..	..	*£466 11 7* 5,598·93	12·563
Solar oil 170,234 kilos. = 167 tons 14 cwt.		*£169 3 7*		*£104 4 3*	
Stoking wages and attendance to engines		2,030·15	4·47	1,250·56	2·806
Enrichers 26,722 kilos. = 26 tons 6½ cwt. benzol. 25,675 kilos. = 25 tons 6 cwt. benzine.		*£467 17 6* 5,614·52	12·364	..	..
Wages for purification		..	..	*£3 16 0* 45·56	0·102
		11,495·77	25·315	10,668·49	23·937
Deduct tar yield, 32,229 litres		*£957 19 7* ..	..	*£889 0 10* 315·38	0·708
				£26 5 8	
		11,495·77	25·315	10,353·11	23·229
Maintenance, water supply, and lighting		*£957 19 7* *pro*	*mem.*	*£862 15 2* *pro*	*mem.*
Paid for installations—					
373,686·00 (*£31,140 10s. 0d.*)	359,245·00 (*£29,937 1s. 8d.*)				
4 per cent. interest and 4 per cent. amortization: 29,894·88 (*£2,491 4s. 10d.*) calculated over a total yearly yield of 60 million cubic metres of gas by both works for each	28,739·67 (*£2,394 19s. 5d.*)	..	4·980	..	4·790
		..	30·295	..	28·019

Note.—The amounts in ordinary figures in the table are florins; those in italic type are the equivalents in sterling—1 pound being calculated as equal to 12 florins. In the figures relating to production, 1000 cubic feet have been taken as equal to 28·315 cubic metres.

Including the wages paid for attending the exhausters and the transport of coal, the figures are—

	West Works.	East Works.
1901	1·87	1·48⁹
1902	1·90⁴	1·47⁶
1903	1·97⁸	1·47²
1904	1·68⁹	1·32⁹

These figures show a saving at the East Works in the first case from 0·30⁵ fl. to 0·38⁹ fl., and in the second case from 0·36 fl. to 0·50⁶ fl. per ton of coal carbonized.

The Cutler Water-Gas Plant at the East Works.

The speaker also gave some particulars of the newly-erected carburetted water-gas plant of Messrs. S. Cutler and Sons at the East Works (a description of which will be found below), and expressed entire satisfaction with the installation; no trouble whatever having, he said, been experienced with it. The make of gas since the starting of it had been as follows:—

1905.	Production of Crude Gas in Cubic Metres.		Consumption of Oil in Litres per 100 Cubic Metres of Gas.
	Total.	Per 100 Kilos. of Coke.	
February-June	1,690,808	149·27	46·59
May only	445,638	155·66	42·64
June ,,	390,924	155·95	44·89

Mr. van Rossum du Chattel also gave the detailed account contained in the foregoing table of the cost of 1000 cubic metres of water gas produced in the East and West Works by the different systems employed. It was pointed out that one must not place too great a value on the approximate figures, as, in the first place, a certain number of pupils were employed to learn as "reserves," so making the cost of labour too high; and, in the second place, the plant had not been working day and night, for fear of introducing a too high percentage of water gas.

Coal-Conveying and Electric Plant.

The next item was the communication of Heer J. M. Muller (Amsterdam) on the De Brouwer charging and discharging machines, the Pohlig coal-conveyor, and the electric installation at the West Works. It was stated that eight beds of regenerator furnaces, standing back to back, each containing nine retorts, 2·75 metres (9 feet) long, were transformed into four beds with nine retorts, 6·73 metres (22 feet) long. Of course, some inconvenience was experienced at the outset with the new machinery, and there was some trouble with the projector not charging the retort far enough, as the coal, being only a very short time on the belt, did not attain the required speed. This, however, was successfully dealt with by providing the belt with copper nails; and afterwards all worked satisfactorily. The retort-house wages for manual labour (except quenching) are 1·06 fl. per metric ton, while those for mechanical stoking, with five charges per diem, are 0·96 fl. As, however, both the charging and discharging machines can be used for one set of four beds more, the cost per ton will be reduced in the latter case to 0·76⁸ fl. The electricity-driven Hunt coal elevator and conveyor is arranged in such a way that it raises the coal from the yard floor, carries it along the outside of the retort-house, and so on to one of the hoppers, or even to both, installed over the two railway viaducts, where it is automatically discharged. Out of these hoppers the coal is charged in 5-ton trucks, and driven by a cable on the railway viaduct to the different beds of retorts. The Hunt conveyor has a total length, including horizontal and vertical runs, of 138 metres (453 feet). The electric motor is capable of developing 25-horse power. The electric plant for lighting and power purposes consists of two De Laval steam-turbines, each of 100-horse power, driving two parallel connected generators, each of 36 kilowatts.

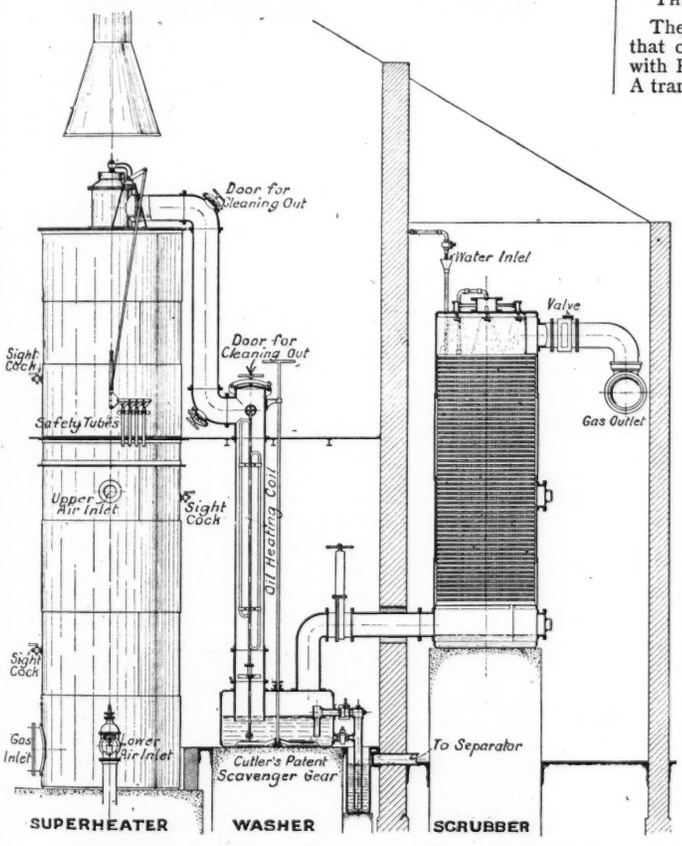
The Coke-Conveying Plant.

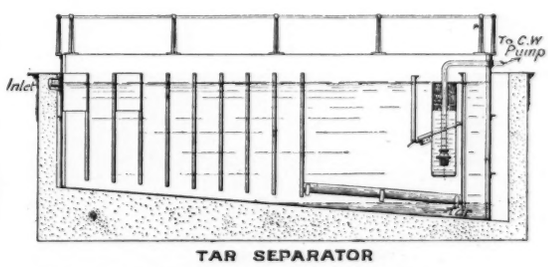
Heer W. K. N. Geerling, of Amsterdam, then read his paper on "The Mechanical Transport of Coke at the Amsterdam Gas-Works." As this paper will be dealt with more fully in a subsequent issue of the "Journal," only the conclusion arrived at is mentioned here—that, though the profit realized by the mechanical transport of coke is not very great, there is no desire to revert to manual labour.

The "Blue" Water-Gas Plant at the West Works.

The next communication concerning the Amsterdam works was that of Dr. L. J. Ferneden, in which he related his experience with Kramers-Aarts "blue" water-gas plant at the West Works. A translation of this paper is given on page 237.

The technical business at the meeting will be further noticed in a subsequent issue.





The Carburetted Water-Gas Plant (Cutler's Patents) at the Amsterdam Municipal Gas-Works—Eastern Station.

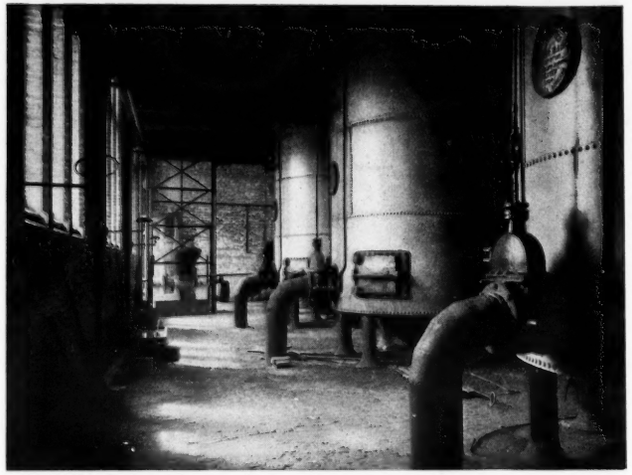
THE CUTLER WATER-GAS PLANT AT THE AMSTERDAM (EAST) GAS-WORKS.

In the general report of the proceedings at the recent annual meeting of the Dutch Association of Gas Managers at Amsterdam which appears elsewhere, reference is made to the installation of carburetted water-gas plant which has been put up by Messrs. Samuel Cutler and Sons at the East Gas-Works. The general arrangement of the plant is shown in the accompanying diagrams and reproductions of photographs; and the following is a description of the plant.

The installation comprises three sets of generating plant, each capable of producing nominally 20,000 cubic metres, or about 706,000 cubic feet, of gas per diem. It is accommodated (including the washers) in a spacious building with an annexe containing the scrubbers and condensers. The fuel supply to the generators is arranged by filling the coke-charging buggies at the ground level from an adjacent coke-store, and then elevating them by hydraulic lift to the charging-stage.

The plant is fitted with Cutler's patent interlocking gear, which consists of a method of interlocking the steam and air valves. The alternation of gas and air in the same vessels presents the possible requisites for explosion; and although the two vapours should not be in explosive conjunction, there is a possibility of this if, by negligence or forgetfulness, an operator opens the steam-valve and starts making gas before the air-valves are closed. The gear is automatic in action, and entails no further work on the operator—in fact, it assists him in carrying out, in proper sequence, the various manipulations necessary in changing over from "run" to "blow," or *vice versâ*. Each section of apparatus

THE OPERATING STAGE.
(View from the Staircase.)



THE GENERATOR HOUSE.

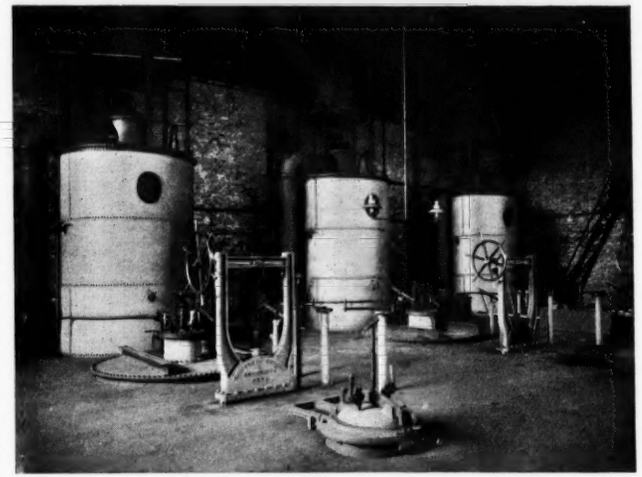
is also fitted with another safety device introduced by Messrs. Cutler—namely, vent-pipes to the air-valves. From each air-valve is carried a pipe leading to a rack fixed on the side of the superheater above the charging-stage. A series of cocks are attached to the terminals of these pipes, and actuated automatically by the lever operating the stack-valve. During the period of gas making, the cocks are all opened; thus giving free vent for any leakage of gas from the vessels passing into the air-main through a leaky air-valve. Should any grit accumulate under an air-valve, and allow gas to pass, it is immediately seen and the valve located.

The oil-sprayers are constructed on a novel principle. In order to obtain the maximum efficiency of oil consumption in a carburetted water-gas plant, it is essential that the oil-spraying arrangements should be always working properly, and that a finely-divided spray, which should also be adjustable in area, should be maintained. It involves delicate mechanism within the sprayer to attain these objects. On the other hand, the sprayer should be placed well within the heated zone of the carburettor dome, and is consequently subjected to the action of the flame during the blow. Messrs. Cutler's latest arrangement consists of a sprayer working through a stuffing-box on the carburettor manlid, and, with suitable gearing, is withdrawn from the interior during the blow. On commencing the run, a lever is depressed which lowers the sprayer into its working position, and at the same time turns on the oil supply. The act of raising the sprayer at the end of the run likewise turns off the supply.

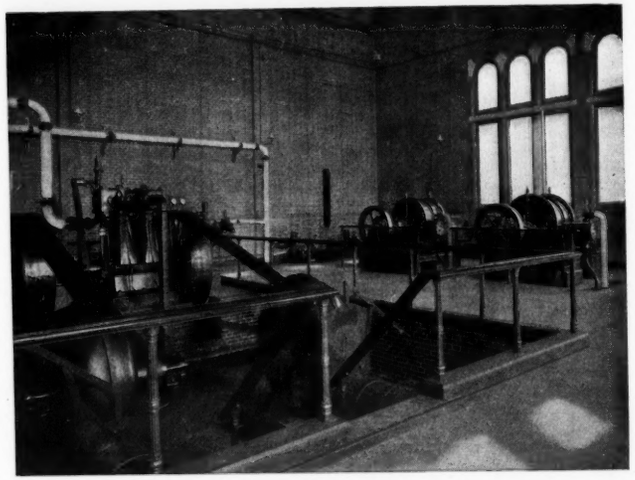
Each section of the apparatus is fitted with Messrs. Cutler's dust interceptors, which provide for arresting the coke dust that issues from the superheater chimney during the blow. Fine particles of coke are mechanically carried in the air-blast from the generator, and cause trouble by depositing on buildings in proximity to the plant-house. The dust is passed through water vapour and caused to precipitate by impingement on baffle-plates, and is then withdrawn from the receiving-tank in the form of sludge. The sludge-valve is manipulated by means of a chain from the operating stage, and once a day the sludge is removed by drawing it off into a settling-tank placed outside the building on the ground level.

The circulated water and tar effluent arrangements have all received special attention; the method employed having for its result that the only product to be withdrawn is the tar for sale. An overhead tank placed above the roof of the scrubber and condenser annexe forms the circulated water-tank, and holds the water which by gravitation falls to the scrubbers, and, issuing from them hot and tarry, passes through the washers and thence to the tar separator. Here it is mechanically freed from tar and pumped back to the overhead tank. The tar is withdrawn from the separator, and stored in tanks above it. Occasionally a little additional water is supplied, so as to compensate for unavoidable evaporation.

A sight-feed arrangement is provided on the water supply to the scrubbers, by which the operator is able to regulate from the operating stage the flow of water to these vessels. A secondary water supply is provided from the overhead tank to the washer, and is fitted with a similar sight-feed, to draw off the tarry deposits, and prevent the accumulation of solid matters such as lampblack, heavy tars, coke dust, &c.; and in order to assist in their immediate removal, a serrated-edged arm is fixed in this vessel, and periodically rotated by a spindle carried up to the operating floor. The water-pumps placed in the engine-room work continuously;



THE OPERATING STAGE.
(View from the Hydraulic Coke Lift.)



THE MACHINERY HOUSE.

and any excess of water delivered to the overhead tank is returned to the separator by an overflow-pipe.

The engine-room, as will be seen from the illustrations, is an imposing one—lofty and well decorated, with mosaic floor and tiled dado round the walls. All the machinery is in duplicate; each unit being capable of serving the three sets of apparatus working simultaneously. The engines are of Tangye's "Archer" type, double-cylinder vertical, of 80-horse power, running at 300 revolutions per minute, and driving No. 9 Sturtevant blowers. Following Messrs. Cutler's usual practice, the blowers are placed in a pit, protected by a mahogany polished rail supported on cast-iron standards. The junction-piece between the blowers and the air-main is of cloth, to form an explosion chamber, and is made just sufficiently strong to take the maximum air pressure requisite for operating the plant. A wire network guard covers this portion of the exposed pipe.

The engine-room contains the necessary oil-pumps, circulating water and tar pumps, and a pair of direct-coupled steam-driven exhausters. A safety bye-pass governor is also placed adjacent to the exhausters, which, in the event of the relief gasholder becoming inadvertently cleared, couples the inlet and outlet mains of the exhauster, and prevents any possible damage to the holder. A carbonic acid test recorder and cycle recorder is fitted up in this room, together with wall indicators to show the level in the water-tanks, tar separator, and gasholder contents.

The range of buildings forming the complete installation comprises a purifier-house containing four purifiers fitted on the Jäger system, a meter-house and laboratory, where a staff of chemists are appointed to make continuous tests and analyses of the gas as produced. The plant was completed on Feb. 15, on which day gas making was commenced, and has continued without interruption. The installation was taken over by the authorities at the end of the probationary period, and it has given complete satisfaction; the guarantees being fulfilled in every particular.

THE KRAMERS AND AARTS WATER-GAS PLANT AT AMSTERDAM.

By Dr. L. J. Ferneden.

[A Paper read at the Annual Meeting of the Dutch Association of Gas Managers.]

I should not be surprised if, in addition to the desire to meet and speak to each other, and to hear and see something new in connection with gas manufacture, the members of the Association had come to the meeting with some curiosity as to the water-gas plant at the West Gas-Works. Ten years ago few of them had seen a water-gas plant, and many were desirous to make the acquaintance of apparatus which in so very small a space could produce so much gas, and do it so rapidly. But, by this time, who has not seen water-gas plant in working order? Curiosity, therefore, now only applies to the system and the results. Though it was generally known that at Amsterdam an installation of the Kramers and Aarts system had been put up, few possessed definite statements as to its working. It was rumoured, however, that it would not succeed—that the system had, indeed, proved a failure. I hope to show you how far rumour is right.

The installation was arranged for the production of 60,000 cubic metres (about 2¼ million cubic feet) of gas per 24 hours. It consists of one main building with separate gas-meter house and laboratory, and a relief gasholder of 2000 cubic metres (70,000 cubic feet). In the gas-meter house are installed two station meters, each of 30,000 cubic metres capacity. The laboratory, with the photometer-room, is specially intended for checking the manufacture of water gas. The principal building is divided into three sections, consisting of a boiler-house, engine-room, and generator-room. Steam is furnished by four Lancashire boilers, each having a heating surface of 150 square metres (about 1600 square feet), with superheaters. Coke dust is used as fuel; and it is burnt on Kudlicz grates, providing steam at a cost of about 5 c. per 100 kilos. The four boilers are not needed for the manufacture of the water gas. They serve at the same time as reserve boilers for the coal-gas plant. In the engine-room four Willans engines of 50-horse power have been erected, which drive the blowers. These displace about 850,000 cubic feet of air per hour, for which they make some 1650 revolutions per minute. Normally, the engines work with 450 revolutions, at 8½ or 9 atmospheres.

The generator-room, with stage operating floor, has four sets of water-gas apparatus. Each set consists of two generators, two regenerators, one recuperator, and one scrubber. The scrubbers and recuperators are placed on the operating floor; the regenerators and generators being below it. Above this floor are the handles of the four air-valves, the recuperator valve, and the gas and steam valves. The manipulation of the plant is simple. The operator opens the recuperator valve, and thereupon, by one movement, the air-valves. After 45 seconds, these valves are closed, and at the same time the gas and steam valves are opened. On the succeeding "run," the second gas and steam valves are opened. There is no need to go into further detail in regard to the principle of the system; this having been done already.* I only wish to remind the members that during the "blow" the two generators are working about 45 seconds next to each other, and during the "run" about 5 minutes after each other.

It was on the 12th of January of this year that the first set was heated up; and at nine o'clock gas was passing from the apparatus to the relief holder. Everything went well till the second run. Scarcely had they begun when the connecting pipe from the generator to the scrubber cracked, and an explosion followed. A period of struggle against unceasing vexations, reverses, and difficulties ensued. First one thing happened and then another; but, of course, always what was not wanted. However, though some difficulty may still arise, we are convinced that the plant has passed beyond the region of experiment. Though we often despaired, the conviction arrived at by the Director of the Municipal Gas-Works of Amsterdam, who had the courage to establish a new system of a young company which had not been tried on a working scale, is proved to have been well founded. Some technical defects have been adjusted, and the water-gas plant is now doing its duty.

The explosion already referred to arose (and it occurred again) from the condensation of steam in the outlet of the generator. After that water was sucked in out of the scrubber, and the pipe cracked. The grates also caused much trouble. The space arranged between the grate-bars was too narrow. On the down run in the second generator the grates became very hot; the clinker accumulated on the grate and clogged; and the back pressure increased. We got large quantities of carbonic acid; and clinkering was harmful alike to the men and the grates. The adoption of widened grate-bars, however, brought the much-needed improvement. The excessive and useless space in the regenerators produced at the beginning 10 to 12 per cent. of nitrogen; but a modification in their form, together with a more appropriate lining of bricks, has reduced this figure to about 4 per cent., and frequently to 2 or 3 per cent.

But I need not dwell further on these troubles, but will ask, What has the system, as employed by us, done? What are the working results? Before replying to these questions, the latter should be clearly stated. What do we understand by "working results"? Simply the yield of gas per unit of coke or carbon. This, however, is not so very simple, because all depends upon the mode in which it is stated. The working results obtained during a few hours' run, under determined conditions, may be perfectly correct; but they do not form a basis to go upon. Neither can the figures arrived at after some months' or even a year's working be called the "working results" of the system, though these figures are the only ones which, regarded from a commercial standpoint, are of any importance. For example, at Pettau, where tests were made during five hours, the working result was 1 cubic metre of gas from 1 kilogramme of brown coal. In the year 1901, the yield was only ⅔ cubic metre, though 20 per cent. of coke was added. Therefore the figures showing "working results" cannot be well compared, and most of them are absolutely worthless.

A well-known mode of recording working results is as follows: The generator is heated up, and after from six to eight hours' gas making, during which period the generator is constantly replenished, the latter is filled up again. The quantity of gas produced, divided by the coke used, gives the working result. Thus a Dellwik-Fleischer plant at Warstein recorded during six hours' working 2·40 cubic metres of water gas per kilogramme of coke; and on another occasion 2·55 cubic metres. At Pettau, with the Strache system, during seven hours' working they obtained 2·50 cubic metres of water gas per kilogramme of coke (2·78 cubic metres per kilogramme of carbon) on one occasion, and 2·17 cubic metres per kilogramme of coke (2·44 cubic metres per kilogramme of carbon) on another. In Amsterdam we had (average of 15 seven-hour tests) 2·03 cubic metres per kilogramme of coke, or 2·71 cubic metres per kilogramme of carbon. Taking the two seven-hour tests, which showed the best results, the figures are 2·30 for coke and 3·07 for carbon. With regard to our tests, I may add that they were taken when gas making was in full swing, without bringing the apparatus into the most favourable condition, on fifteen successive working days. But more in keeping with the daily results are the following: In a 24-hour test Herr Dellwik obtained at Erfurt 2·01 cubic metres per kilogramme of carbon; and in a 36-hour test at Barmen-Rittershausen, 2·30 cubic metres. The Kramers-Aarts system gave as the result of a 48-hour test, made on June 20-21, 2·23 cubic metres; and in a similar test on June 30 and July 1, 2·41 cubic metres.

The following are the working results in cubic metres of gas per kilogramme of coke obtained at certain gas-works, taken over a full year:—

Charkov (Strache)			1·02
Nürnberg (Dellwik),	1900		1·27
,, ,,	1901		1·52 (1·73 carbon)
Arnheim	,,		1·80
Ludwigshafen	,,		1·80 (2·22 carbon)
Remscheid	,,	1904	1·34
Plauen	,,	1903	1·38
Iserlohn	,,		1·04

The figures for a full year's working cannot yet be given for Amsterdam. June may be considered as a month of ordinary production, and the yield was 1·55 cubic metres of gas per kilogramme of coke, or 2·06 cubic metres per kilogramme of carbon. You are therefore able to form an idea as to what the Kramers-Aarts system can do. I expect, however, that future figures will

* See "Journal," Vols. LXXIX. and LXXX.

be still better. The average percentage composition of the gas produced during June was: CO_2, 4·7; O, 0·1; CO, 41·3; CH_4, 0·3; H, 49·4; N, 4·2. The calorific value was 2630 calories. The costs of the "blue" water gas, including interest and amortization, were in May 1·65 fl., and in June 1·63 fl. per 100 cubic metres. Auto-carburation is only partially applied. The water gas is mixed with the coal gas as it comes from the hydraulic mains before it reaches the condensers. Taken over June, the proportion was 20 per cent. After having passed the purifiers, the gas is carburetted. If the quantity of benzol needed to keep up an illuminating power of at least 15 English standard candles, and a heating power of at least 5000 to 5100 calories, is taken into account, the cost of carburetted water gas has been for May 2·85 fl., and for June 2·45 fl. per 100 cubic. metres of gas, both prices including interest and amortization The conclusion we may draw from the preliminary results is that the Dutch system of producing water gas may be freely compared with the long-tried foreign systems. But whether it is better or worse I must leave to the future and to your own judgment to determine.

FRENCH IMPROVEMENTS IN GAS-METERS.

Three of the papers submitted at the recent congress of the Société Technique du Gaz en France dealt with the subject of gas-meters and their verification and registration. The following are the principal features of the communications.

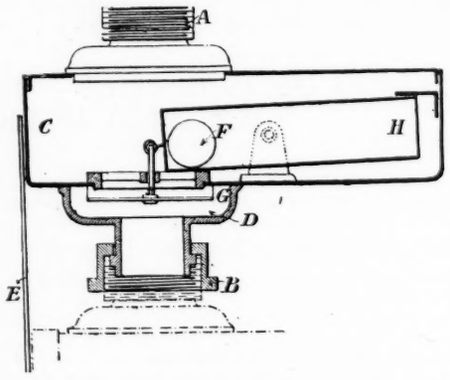
The general question of the use of wet or dry meters was introduced by M. Naudé, one of the Sub-Engineers at the Havre station of the European Gas Company. He reminded the members that at the International Congress held in Paris in 1900, M. Bigeard, of Angers, directed attention to the advantages of dry meters, and urged that these were sufficient to counterbalance any slight defects, and to justify the acceptance of meters of this class for stamping by the French authorities. The author said it was not his intention to discuss the merits of dry meters, but merely to notice the objections which had been raised to them. The first and greatest, so far as France is concerned, is their irregularity in working. This is attributable to various causes, notably to the defective way in which the leathers are fitted, the effect of which is that they do not always return to the same position after successive movements. The defects in registration arise first of all from the pressure absorbed by the meter, and secondly from the alteration in the original form of the leather. With 5-light dry meters, whether new or after having been in use, M. Naudé had never found variations to the extent of more than 2 per cent. for deliveries below 28 cubic feet, and 4 per cent. between this quantity and 70 cubic feet. Temperature also affects registration; but it does so to practically the same extent in the case of both wet and dry meters. With regard to fraudulent consumption, M. Naudé acknowledged that, though the dry meter prevents this in many cases, it is not proof against the manipulations of the dishonest consumer.

After these general remarks, the author proceeded to recount his experience with dry meters at Havre. He said that for three or four years they had had about 15 of these meters in use without a single hitch. They had tested some of them, after they had been in operation two or three years, and they acted perfectly; the working parts being absolutely as good as new. There had been no trouble with naphthalene obstructions or with condensation. The average back-pressure with 5-light dry meters was much less, in the case of ordinary deliveries, than by wet ones. He had not yet employed any dry meters larger than the 10-light size; but he pointed out that they were in general use in other countries. He recalled the members' attention to the fact that at the congress last year M. Lacaze brought under their notice the "Constant" meter, which obviated almost entirely the irregularities of measurement which were the defects of dry meters. He gave the results of a comparative test of three meters—an unvarying water-line meter, a "Constant" dry meter, and an ordinary dry meter—placed one after the other. The trial extended over two months, during which time 100 cubic metres, or about 3500 cubic feet, of gas were consumed. The following were the figures (in cubic metres) registered: Invariable meter, 99·65; "Constant" meter, 100; ordinary dry meter, 101·06. The quantity of water evaporated in the wet meter was 0·7 pint, which would have given with an ordinary wet meter an average error of 1·6 per cent.

The author summed up his remarks by submitting that, in view of the improvements effected in the manufacture of dry meters, which render their registration almost as accurate as that of unvarying water-line meters, they should, equally with the latter, be admitted for official stamping, which at present they are not. This, indeed, has been practically acknowledged by the National Weights and Measures Department, though their conclusions have not yet received official sanction.

In the course of the remarks upon the paper, the President (M. Visinet) agreed with the author that, as dry meters were coming to be generally employed, an effort should be made to have them stamped. M. Chamon remarked that, without in the least questioning the accuracy of dry meters, it was the wet meter that was invariably employed in photometrical operations. He pointed out that in Germany, where dry meters are very numerous, inspection and verifications have to be frequently made owing to the quality of the leathers changing and the working parts becoming loose, resulting in defective registration of the gas consumed. M. Delahaye remarked that, as the question of the official stamping of meters had been incidentally raised, in the report of M. Perot, the Director of the Laboratory in the Conservatoire des Arts et Métiers, mention was made of a fee of 1 fr. per burner. He gave some statistics of the returns from the stamping of meters in Germany and in Paris, and showed that the average in the former was 20 c. per burner, whereas in the latter it was 9 c. He thought the intervention of the State in this matter would entail more expense to both suppliers and consumers of gas, who would have to submit to the exigencies of the Weights and Measures Department. M. Bigeard laid stress upon the advantages of dry meters in rendering unnecessary both inspection and watering, which, in the case of wet meters, require three or four visits in the course of a month by men from the works. According to his personal experience, excellent results were being obtained at Angers with dry meters.

In a short communication presented by M. Besnard, he explained the action of a small appliance which, placed at the outlet of the meter, cuts off the gas when the meter is tilted forward, whether purposely or otherwise, sufficiently to cause incorrect registration by altering the water-level. The arrangement, which is shown in the accompanying illustration, consists of a rectangular box C, furnished with two screw-threaded attachments A B, which permit of its insertion between the meter proper and the outlet-pipe. In the space D is placed the valve G, which allows the outlet to be either isolated or connected with the interior of the box. This valve is actuated by a cylinder H,



which oscillates freely. In this cylinder there is a metal ball F, which can run from one end to the other. E is a protecting plate of sheet iron. On the appliance being screwed to the meter, the ball is on the side of the valve which is open—the cylinder inclining slightly backwards. If the meter is tilted in the opposite direction, the ball passes to the other end of the cylinder, the valve closes, and the gas is shut off. This takes place if the back feet of the meter are raised only ½ inch, or even less. In order to restore the appliance to its original condition, all it is necessary to do is to slightly tilt the meter backwards, when the sound of the cylinder will indicate that the passage is open.

M. Maldant remarked that an arrangement somewhat similar to the one just described was devised some time ago by M. Perthuis, the Manager of the Nantes Gas-Works, as well as by M. Bruxelles, of Grenoble. M. Marchal, who is now at the first-named town, stated that the meters furnished with the appliance of M. Perthuis were giving every satisfaction, as they checked the perpetration of frauds by the tilting of gas-meters. M. Gaston Gautier, of Havre, dwelt upon the advisability of sealing the meter to the wall, and emphasized the advantage of employing only unvarying water-line meters. Of course, the more general adoption of dry meters would be an effectual remedy for this as well as other troubles attending the use of wet meters.

The last paper in the group was one by M. Dupoy, in which he described an arrangement for maintaining the water-level in gas-meters which has been applied by the Société Industrielle des Compteurs to their "Duplex" meter. It consists chiefly in the employment of cups or scoops, mounted on the exterior of the meter drum, which serve to take up, at each revolution, a certain quantity of gas, which is utilized for inducing a mechanical feed of reserve water contained in the hydraulic compartment of the meter, and delivering it in small quantities at a time into the case of the drum, which is provided with an overflow; thus ensuring a continuous supply, and the maintenance of the liquid in the case at a constant level. The arrangement was fully described and illustrated in the "Register of Patents" in the "JOURNAL" for Nov. 15, 1904. For a 5-light meter, about a quart of water is required as a reserve, and it should be sufficient for the passage of 10,000 cubic feet of gas—say, two to three months' consumption; but M. Dupoy suggested that it would be advisable not to allow this limit to be reached before filling up the reservoir, so as to keep the meter always in a condition to register accurately. No remarks were made upon the paper.

NORTH BRITISH ASSOCIATION OF GAS MANAGERS.

ANNUAL MEETING AT ST. ANDREWS.

The North British Association of Gas Managers held their Forty-Fourth Annual Meeting at St. Andrews last Thursday. Owing to the early start of the proceedings, there was but a small attendance at first; but on the arrival of the forenoon trains, it was found that the attendance was up to the average—being quite as good as that which graced the meeting in Glasgow last year. The meeting was held in the Great Hall of the United College of the University, the use of which had been granted to the Association through the efforts of Mr. J. Hall, the Senior Manager of the St. Andrews Gas Company. The President, Mr. J. W. Carmichael, of Barrhead, took the chair shortly after ten o'clock.

Welcome to the Town.

The President said he was very pleased to give them a welcome to St. Andrews. They had a long and varied programme before them, which would require all their time if they were to do justice to it; but he hoped there would be good discussions on all the papers which were to be read. He would like to say how much the Committee were indebted to Messrs. Hall for the help they had given them in the perfecting of the arrangements for the meeting, and to Mr. Hall, senior, for using his influence with the University authorities in securing them so beautiful a place in which to hold their meeting—a hall full of ancient and historic interest. It afforded him very much pleasure to introduce to them the Chief Magistrate of St. Andrews—Provost Murray—and also Bailie Aikman, the Chairman of the St. Andrews Gas Company. Both gentlemen, so long as he could remember, had interested themselves in the improvement of the town. They had long occupied seats at the Council Board, and had devoted much of their time for the good of the Royal and Ancient City. They were there to give them a welcome to St. Andrews.

Provost Murray desired to thank the Association for the great honour they had done the city in selecting it as the place of meeting. They were extremely glad to see them there, and gave them a most cordial welcome. They would find St. Andrews a very interesting little city in every respect, especially in connection with its ruins and the historic recollections they recalled. However, he expected that it was there that they would spend a considerable part of their time. The Association came home to the people more than perhaps many knew; for the subjects they dealt with were always interesting, and they always ended in some advantage being conferred upon the general community. He hoped they would enjoy themselves, and come back to St. Andrews much sooner than they had done this time. It was now twenty-seven years since they visited the city before. He had great pleasure in being there to welcome his old and respected friend Mr. Carmichael. Mr. Carmichael served his apprenticeship with Mr. Hall there; and they in St. Andrews had always taken a kindly interest in him since. It was an honour to them that they should come there, and it was a great honour that, when they came, their President should be a St. Andrews man. He gave them all a hearty welcome to the old city.

Bailie Aikman said he had much pleasure, as representing the Directors of the local Gas Company, in joining in the hearty welcome which the Provost, as representing the citizens, had given them. When the Association met there before, it was under the Presidency of their venerable and worthy friend Mr. Hall, their Gas Manager; and he thought he might venture to say that if the members of the Association were like Mr. Hall in personal character and in devotion to work, they would be a very fine set of men indeed. It was very fitting that, when they had come there again, their President should be an old St. Andrews man—one who was trained under Mr. Hall, and whose subsequent career had been a credit both to himself and to Mr. Hall. There had been a good many changes since the Association met there before. Then there was no great competition for public lighting; but since then they had a very serious competitor in the shape of electricity. When gas was first introduced, it was said that an old lady exclaimed, "What'll the poor whales do now?" He did not know that gas had relegated whales to the order of extinct animals; and he did not anticipate that the introduction of the electric light—handy and useful and clean though it undoubtedly was—would make gas manufacture one of the lost arts. He observed that one of the papers was upon "The Competition of To-Day." He had no doubt but that Mr. Reid would give them many valuable hints as to how the demand for gas was not only to be maintained but extended. Locally they had found that the use of gas for cooking had opened up a very wide field, which he thought it would be their duty to occupy. In the name of the St. Andrews Gas Company he gave them a very hearty welcome.

The President said he felt very proud indeed that he had his old master—Mr. Hall—supporting him on the platform that day. Little did he think, twenty-seven years ago, when he gave his little assistance to help in carrying out the arrangements for the meeting, that he should be the next President in St. Andrews. But so it had happened. Mr. Hall had been made an Honorary Member of the Association. This was the highest honour they could confer upon him; and they hoped he would live long to enjoy it. If Mr. Hall would like to say a few words, they would be very pleased to hear him.

Mr. J. Hall said that had it not been that the invitation to speak had come from one of his old boys, now in the Chair, he would have preferred to have sat still; but after the many kind things which had been said, and surrounded as he was by so many kind friends, including the Provost of the city and the Chairman of the Gas Company, he felt it appropriate that he should return them his thanks for their remarks regarding him. He might say that both the Provost and the Chairman of the Gas Company, in their capacity as Directors of the Company, did not treat him as Gas Manager at all, but as a friend. They had always done so; and he was proud of their friendship. He wished the members a very pleasant time at St. Andrews.

The President, in the name of the Association, and in his own name, tendered the speakers their sincere thanks for the honour they had done them by their presence, and for the hearty welcome they had extended to them.

The Report of the Committee.

The Secretary and Treasurer (Mr. R. S. Carlow) read the report of the Committee, which stated that the Benevolent Fund had been drawn upon during the year; a donation of £10 having been granted to one deserving case. The Committee had again been in communication with the meter makers upon the subject of the standardizing of meter-unions, and were glad to be able to state that they had got all the manufacturers to fall in line, and keep in stock meters with the standard unions attached to them. Any gas engineer or gas manager ordering meters with the standard unions would be supplied with them. Nothing further had been done in the matter of the publishing of Mr. W. Young's communications to the Association. At the last annual meeting, the members decided that the Association should not affiliate with the Institution of Gas Engineers; but since then correspondence on the subject had been going on between the Institution and the Committee of the Association. The Committee had given the matter their most careful consideration, and had resolved to lay the question again before the members at this meeting, and let them decide for themselves whether affiliation was to take place or not. A number of members of the Committee visited the Earl's Court Gas Exhibition in London in November last, and they were highly gratified and pleased with what they saw, having inspected all kinds of up-to-date gas apparatus and appliances. The exhibition was well worthy of the visit made. The Committee, in recognition of the large amount of extra work and outlay the Secretary had making and completing the excellent arrangements for conveying the party to and from London for the visit, unanimously voted him ten guineas from the Research Fund. Correspondence had been going on for some time between the Southern District Association of Gas Engineers and Managers and the Committee, on the subject of a naphthalene inquiry; and the Committee, after making careful investigation as to what the Southern Association had done, as an Association, unanimously resolved to grant them a sum of £20 from the Research Fund, to assist them in bringing their inquiries to a successful termination. Members would observe that the Committee had not been idle during the year, but that they had considered some very important matters affecting the Association, and matters which would be discussed and settled by themselves there that day.

The Committee unanimously recommended that Mr. J. Hall, Gas Engineer, of St. Andrews, be elected an Honorary Member of the Association.

The President said there were some very important questions dealt with in the report; and he would be very pleased if any of the members had any expression of opinion to give upon them. According to the programme, the affiliation question came first; but he thought they might defer this subject till the arrival of some of the members who were coming by a later train, so that they might not be accused of taking a snap vote upon it.

Mr. J. W. Napier (Alloa) called the attention of the members to the vote of ten guineas to the Secretary from the Research Fund. He did not, in any way, grudge Mr. Carlow the money which had been voted to him; but he did most earnestly object to the sum being taken from the Research Fund. The fund was instituted a good number of years ago, by Mr. Hislop, for the purpose of conducting investigations and research into the technical side of their industry. He was quite satisfied that Mr. Hislop would turn somewhat aghast at ten guineas being taken from the fund to cover merely extra labour on the part of any official of the Association. He must admit that a journey to the Earl's Court Exhibition was fraught with very considerable importance to the industry; but he thought the item ought to have been put against the General Fund.

The President said the Committee considered that Mr. Carlow was very justly entitled to the ten guineas, not only for his expenses in going to London, and accompanying them on their official visit, but also in connection with the large amount of work he had had to do on the question of the standardizing of meter-

unions. This work had been going on for years; and they had no idea of the amount of work Mr. Carlow had had in connection with it. Their visit to the exhibition was really research work; he did not think there was any doubt about that. This was the way they looked at it, and it was the reason they voted the sum. They did not think it too much—in fact, they regarded it as too little—for the work Mr. Carlow had done.

Mr. NAPIER repeated his objection.

THE ROLL OF THE ASSOCIATION.

The SECRETARY submitted the report of the Committee upon the roll of the Association, in which the following were submitted for admission to the Association:—

Honorary Member.—Hall, Jesse, St. Andrews.

Ordinary Members.—*Barker, John, Nairn; Chalmers, W., jun., Dalmillington; *Fairweather, Charles, Kilmarnock; Hall, Robert, St. Andrews; Scott, Robert, Blantyre; Wynne, Jas., Carnoustie.

Extraordinary Member.—Morris, David, gas-stove maker, Edinburgh.

Associate Members.—Chalmers, Alex., Gas-Works, St. Andrews, Williamson, W. M., Gas-Works, Leven, Fife.

During the year, it was reported, six members ceased to be connected with the Association, through death, resignation, or otherwise; and one associate member had resigned. Three honorary members—Messrs. G. T. Myers, of Broughty Ferry; A. Smith, of Aberdeen; and P. Watson, of Stirling, died during the year. Deducting those who had ceased to be connected with the Association, and adding those who were being admitted that day, the membership stood at 232—a decrease of 2.

The PRESIDENT moved the adoption of the report.

Mr. W. BLAIR (Helensburgh) seconded; and the motion was agreed to.

THE AUDITOR'S REPORT.

Mr. R. B. MAIN (Glasgow), the Auditor, submitted his report. The General Fund showed an income of £125, the Benevolent Fund of £37 (the fund now standing at £365), the Research Fund of £13 8s. (the fund now standing at £164), and the Excursion Fund of £127—there being £32 in hand. Mr. Main said he was sorry he was not in a position to congratulate the Association on such a good report as a year ago. There had been some extraordinary expenditure in connection with the Earl's Court Exhibition and a number of additional meetings. They started the year with £14 in the General Fund, and they left off with £6. But he thought they would agree that the money had been well expended. He was glad to say that the Benevolent Fund was steadily increasing. It was about £17 up. He stated a year ago that he thought it would be a very nice thing if they could get the fund up to £500; and he thought that they were within measurable distance of this. The Research Fund was up £5 15s., and the Excursion Fund was also in a healthy condition; so that they were about £23 up on these two funds, and £8 down on the General Fund.

The PRESIDENT moved the approval of the report, which was agreed to. He then conveyed the thanks of the Association to Mr. Main for his labours. Mr. Main, he said, was a busy man, and yet he found time to do that work for them.

INAUGURAL ADDRESS.

The PRESIDENT then delivered his address, as follows:—

Gentlemen,—My first duty in presiding at this, our forty-fourth annual meeting, is to convey to you my sincere thanks for the honour you have conferred upon me by electing me to the position of President of the Association. In calling upon me to occupy this position, I am bound to say you had more confidence in me than I have in myself; and it was with the greatest reluctance I allowed my name to go forward—not that I did not appreciate the honour, but simply on account of distrust in my capacity to maintain the high position our Association has attained, through the eminent services rendered by Past-Presidents who have occupied the chair with so much distinction and ability.

Our ranks, I am sorry to say, have been thinned by the passing away of a few very old friends—viz., Mr. G. T. Myers, Mr. Peter Watson, Mr. John Wilson, Mr. Alex. Smith, and Mr. Wm. Scott. These men all took a very warm interest in the affairs of the Association. Mr. Myers was one of the pioneers in its formation, and up to the last interested himself in its affairs; and on his retirement from active service he was made an Honorary Member. Mr. Watson retired from the service of the Stirling Gas Company in 1897, after having held the managership for thirty-three years. He was regular in his attendance at our meetings, took an active part in the discussions, read papers, and in every way showed his thorough interest in the Association. He was held in high esteem; and to show our appreciation of his services, we also elected him an Honorary Member. Mr. Wilson was long connected with the Tradeston Gas-Works, Glasgow, latterly as Manager, which showed the confidence the late Mr. Foulis had in his ability. He acted as Chairman of the "Informal Meeting" in 1901, and the following year was President of this Association. These events are of so recent date that we cannot imagine he has gone. Never of a robust constitution, Mr. Wilson succumbed to a trouble which had afflicted him for long years. Mr. Smith was more or less connected with the Aberdeen Gas-Works for over thirty-seven years. He was a man who did not spare himself. His life was a busy one; and the ability he displayed in conducting such a large undertaking marked him as a superior man. Being an engineer, he was able to do splendid work for the Corporation; and he was always in advance with extensions and improvements. Tribute was paid to his memory by the Lord Provost and the Convener of the Gas Committee. Mr. Smith was our President in 1879, and took a lively interest in the Association. He was elected an Honorary Member only last year. We have also to record the loss of another member, Mr. Scott, of Blantyre—a gentleman who was assiduous and attentive in the performance of his duties, and who did excellent work for his Company. To all the friends of those I have mentioned, we offer our condolence. I may say, however, that this has already been done by letter, through the Secretary. Each successive year finds the ranks of the founders of our organization growing thinner; and it is but natural that we who knew them should feel regret at their disappearance from among us. But we are hopeful that their places are being filled by a band of promising young men, under whose guidance I hope the Association will grow in usefulness and importance.

On examining our records, I find that it is twenty-seven years since the Association held a meeting in St. Andrews. On that occasion a most successful meeting was presided over by Mr. Hall, who, we are glad to know, is still able to take a part in guiding and directing the gas undertaking of this city. In choosing St. Andrews as the place of meeting this year, it is worth remembering that, though St. Andrews was not the birthplace of our Association, it was in a neighbouring town that it sprang into existence forty-three years ago. The first meeting (held in Cupar, Fife) was presided over by Mr. John Lowden, of Leven.

The Association has grown in importance from year to year since then, and has proved itself of incalculable benefit to our profession, in disseminating information among its members which has been found of great service in our every-day work, as also in the interchange of opinions upon the troubles and difficulties we have to contend with in the prosecution of our calling, and—what is of greater importance—in promoting the friendly feeling that such meetings engender. Our meetings, however, are not recognized as much as they ought to be by those in authority. Admitted that it is the gas manager who derives the benefit in the first place, it is the company or corporation who profit by the experience gained in conferences such as ours. I am pleased to say that in recent years the good accomplished is beginning to be acknowledged, and that many companies and corporations are giving every encouragement to their managers to attend these meetings.

I think the time has arrived for giving our Association a new name; and I suggest that it might be called the Scottish Institute of Gas Engineers and Managers. If this suggestion were adopted, it would, in my opinion, make the Association in name what it already is in reality—a National Association—and would give the organization a better standing in the eyes of the gas world. Who can tell but that if this change had been made years ago the Institution of Gas Engineers might have couched their letter regarding affiliation in very different words?

It appears to me that we are at a very great disadvantage in not having more District Associations in Scotland. This is a matter that ought to be considered. There are many managers belonging to this Association who never take part in the discussions—why, we all know. It is not from lack of ability to speak, but from modesty or timidity in getting up before so many of their associates. I am satisfied that, if District Associations were formed, many who will not speak at the larger meetings would confidently express themselves on topics which would be of mutual interest, and find solutions of knotty points, to the discussion of which the larger Association does not lend itself. The more opportunities a manager has of meeting his fellows in conference, the more will he manage the works under his care in an intelligent and economical manner.

While speaking of Associations, I am sure I speak the mind of all present when I say that we welcome the birth of the Scottish Junior Gas Association. Both Mr. Wilson and Mr. Herring have given it a good send-off. I am glad to think that the Association is making so much progress; and judging from the large number of young men who have joined its ranks, its success is assured. By the study of all modern methods used in the manufacture of gas, the members are training and preparing themselves for the high positions they may be called upon to occupy. I am sure we wish our young friends a successful career.

One of the difficulties Presidents have to face with the ever-increasing number of Associations is to find something new as the text or texts of their addresses—something that will interest and something that has not been touched on before. That, I am afraid, is now an impossibility, as nearly every subject under the sun in connection with the gas industry has been discussed more or less. Although I have no new matter to lay before you, yet I hope I may say something that will be of interest to all.

In taking a retrospective view of the gas industry, one has much satisfaction in observing that it still continues to flourish. It is needless for me to enter elaborately into figures to prove this, after the very important statistics given by Mr. Irving in his Presidential Address to the Institution of Gas Engineers. Let it suffice to say that the capital expended on gas-works in the

*Transfers from the list of associates.

British Isles in 1893 was over £62,000,000, and that it now amounts to the enormous total of nearly £117,000,000. The increase in the quantity of gas manufactured has within the past ten years been equal to 46 per cent. These figures prove, if anything can, that we are more than holding our ground, and give us a fair idea of the magnitude of the industry in which we are engaged. Gas is still in its youth. There is great room for extension and expansion, both as regards power and heat, while there is nothing to hinder gas from being still in the first rank as an illuminant. The fact that Glasgow, Edinburgh, and other places, have sunk so much capital in the erection of new gas-works is a guarantee that the day when gas shall cease to be employed is far distant.

But if gas is to hold the field and become more extensively used, we must not admit for a moment that we have arrived at such a stage of perfection that we can quietly rest and be thankful. Of late years, many competitors have taken the field against gas; but none has wakened up gas managers and gas authorities so much as the electric light, and none has done so much in the way of contributing towards the extraordinary success which has attended the efforts of gas companies in the extension of their business. While we marvel at the increase in the quantity of gas used from year to year, the question we have to ask ourselves is, How are we to maintain our position and, if possible, to carry our success still further? First, I would remark, our young men must be properly trained engineers. Never before has it been so easy for a young man to obtain a college training as at present. Greater attention is now being devoted by our young men to technical studies; and the classes in "Gas Manufacture," conducted both in Glasgow and in Edinburgh, have been largely taken advantage of. I do not mean to say that technical training is all that is needed to fit a man for the work of a gas engineer. The practical training is still the most important part of his education; and a year or two in a well-conducted gas-works is essential for his equipment for the important duties of a gas engineer and manager. It is only by knowledge, and by getting thoroughly grounded in the most economical methods of manufacturing gas, that we can hope to keep our ground, and to accomplish even more than has hitherto been done in the way of popularizing gas.

For the profitable management of the works, the first consideration of every manager must be strict supervision over even little things. At the present time, there is a demand for cheap fuel gas; and if the cost of production can be brought down to (say) 1s. 6d. to 2s. per 1000 cubic feet, the increase in the consumption will be enormous. But to do this, careful and economical management is required. Much of the manager's time and attention must be devoted to the retort-house. It is here that profits are lost or made. Let us, therefore, see that the gas gets a good send-off. This can only be attained by maintaining good and equal heats throughout the settings; and no one should be content until he has a system of heating retorts that will give from 9000 to 10,000 cubic feet of gas per mouthpiece. No part of the apparatus of a gas-works has received more attention of late years than that used for the distillation of coal. Seldom will you see direct-firing employed in any gas-works, even the smallest. It has been abolished, and gaseous firing substituted, on the generator or regenerative principle. There are quite a number of designs available, from which, in most cases, excellent results are obtained. These are suitable for all sizes of works. They have been so often discussed, and their good points are so well known, that further reference to them is unnecessary here. We must remember that a great deal depends on the condition of the retorts; and this accounts very often for the unequal results obtained by two managers working the same coal and carrying on the manufacture, it may be, in a similar manner. Cracks in the retorts, or a little want of attention to the primary or secondary air, may explain the difference in results.

In large works, by the employment of charging and drawing machinery, and by the use of coal and coke-handling plant, the labour expenses have been greatly reduced. But it by no means follows that machinery can be used profitably in small works—indeed, the opposite has been proved. Very careful consideration is required on the part of both engineer and committee before launching into heavy expenditure on such machinery, which has in several instances proved detrimental to the success of the undertaking into which it has been introduced. It is very necessary, however, that the gas engineer should be ever on the alert for machinery that will help to reduce the manual labour to a minimum, and at the same time reduce the labour charges.

In some medium-sized works the De Brouwer charger and discharger has been tried with success; and as the initial cost is small, I feel confident that many works of 100 millions and upwards will adopt it. It appears to me it has a great future before it, and that it will, I am sure, be a step forward towards economy. But someone may say, What about the large number of works manufacturing less than 100 million cubic feet of gas? Well, I see nothing in the form of a machine that it will pay us to use. Consequently, we must just go on in the old way meantime, while always living in hope that some day a machine will be invented, simple and easily manipulated, that will be suitable for nearly all works, whatever the size may be, and so do away with, or considerably lessen, the arduous work of hand-stoking.

Settings of horizontals and inclined retorts have each their advocates; but there is no doubt that improved stoking machinery—such as the De Brouwer projector and the West improved charging-machines—must go a long way to keep horizontals to the front. As to which system will become first favourite, that must all depend on results. Many engineers are awaiting the results of the use of the various machines. The Settle-Padfield retort, which was explained to us at the recent exhibition in London, does not appeal to me as likely to become general, especially in Scotland. It may do in England, where most of the coal is coking coal; but as the coal for this retort must be ground down to a very small size, it will be readily understood that the char from most of the coal used in the gas-works of Scotland would be of little value in such a retort.

Another matter which requires very careful attention is that of condensation. With all our knowledge and progress in the manufacture of gas, we seem to be groping in the dark in this matter. Little or no advance has been made since 1867, when Bowditch, in his work "On the Analysis of Coal Gas," wrote: "The proper object of condensation is the removal from gas of substances produced in the distillation which, for some reasons, are not useful for purposes of illumination, and the retention in the gas of all the substances which are useful as illuminants and can be distributed with the gas." Bowditch seems to have clearly understood even then that it was not by the sudden separation of the liquid from the gaseous portion that the best results were to be secured, but by the slow and regulated cooling of the liquefiable products. This is the correct way to put it. But as to the means by which this dictum is to be carried out, it remains as much a mystery as ever. No doubt various methods have been adopted which have been helpful towards retaining the hydrocarbons and improving the gas; but as to any properly defined rule, there is none. Owing to the unequal quantity of gas manufactured from time to time, and the varying temperature of our climate, it becomes a very complicated problem to arrange for the even cooling of the gas. Yet, if good results are to be obtained, constant attention must be paid to the temperature of the gas, especially at the outlet of the condenser, where it should never be below 60° Fahr.

One system which has found great favour is that of carrying a foul-main round and within the retort-house, with an inclination towards the hydraulic main. As it is inside the house, the cooling is more gradual; and as the condensed liquid flows against the gas, better results are obtained, so far as the illuminating power is concerned.

Dr. Colman, in his paper on "Condensation of Illuminating Gas," read last year before the Institution of Gas Engineers, says that "a gas engineer extending or renewing his condensing plant has little data to guide him in designing an apparatus which shall be most effective;" and the result of the lack of such information, he explains, is that with the plant in daily use it is impossible to maintain the other conditions constant. A change of coal or change of heats, and so on, make the results unreliable; and he thinks this problem can only be solved by having an experimental works. This is the opinion of most men. This and many other matters connected with the manufacture of gas could be improved upon were some authoritative opinion given through the medium of an experimental station. Such a station is required.

Until a few years ago the purification of coal gas was mostly performed by lime; but, principally owing to the difficulty of disposing of the waste lime, many works have been forced to use oxide of iron. In most cases, managers have not regretted the change, as by the use of oxide the purification charges have been reduced. Purification by oxide is more extensively used in England than in Scotland; but of late years it has become quite common in Scottish gas-works, some of which, as we are aware, have dispensed with lime altogether. This means the passing of the carbonic acid; but I question if, where there is efficient washing and scrubbing of the gas, there is much harm done so far as the illuminating power of the gas is concerned, especially in these days, when the cry is for cheap fuel gas. Purification in closed vessels has not proved a success; but possibly all difficulties may be overcome some day, and it may ultimately be adopted as the method of purifying in the future.

Distribution has of late years received great attention, owing to the extended use of gas for many purposes. The day pressure has been very much increased to meet day requirements; yet from the "Statistical Report" it will be observed that leakage has diminished. Possibly owing to increased pressure, leakages that otherwise might never have been found, have been discovered and made good. I believe also that managers are more alive to the fact that it pays to have the distribution plant in good order. This can only be attained by using the best possible material and workmanship.

Once upon a time the supply of artificial light was a monopoly in the hands of gas companies. Because of this there was a certain amount of independence shown, and an inclination to do little to encourage consumers in the use of gas. The advent of the electric light has made us abandon our old ideas and adopt the methods of other commercial men. We have come to see that, if our business is to succeed, we must meet our consumers in a more generous spirit. This is being done in many places both in England and Scotland, where free maintenance of incandescent gas burners, fittings, and stoves has been inaugurated, and mantles, burners, chimneys, and globes are sold at current prices, and fixed without charge. I understand that this new means of popularizing gas has been a great success, and certainly it appeals to me as being the best way to educate our consumers, and to confirm them in the belief that incandescent gas lighting

is not only the best method of illumination but by far the cheapest. In many towns, show-rooms have been opened in which there are displayed burners, fittings, cookers, and other appliances, all made to catch the eye. In these and various other ways, gas has been kept well to the front; and we have been enabled to get into closer touch with the general body of our consumers—interesting and educating them in the best appliances to use, so that they may have the very best results from the gas burned. From those who have launched out into the provision of show-rooms, we learn they are highly satisfied with the results. Such methods are worthy of our best consideration. To those who sell gas at a reduced price for power and heat, the "Rotary" discount meter ought to be of some advantage. Its small size, and its appearance, suit the requirements admirably. The smallest size is for 15 cubic feet per hour, and measures within 3 per cent. of accuracy at all rates of flow from 5 cubic feet per hour. This meter is not intended to replace the ordinary meter, but is only for use where differential rates are charged.

The greatest rival of gas at the present time is electricity, both for lighting and power; and yet wherever electricity has been introduced, the consumption of gas has gone up by leaps and bounds. As far as price is concerned, either for light or power, gas can well hold its own. A friend of mine in Glasgow has a 15 brake horse power gas-engine driving a 7 ft. 6 in. air propeller; and the cost of gas is from £3 to £4 per month—the gas being bought at the rate of 2s. per 1000 cubic feet. The cost of electrical energy for a 15 brake horse power motor driving a similar sized air propeller is £7 to £8 per month, with the current charged at the rate of 1½d. per unit. From this, you will observe that electricity is about double the cost of gas, although the electric current is charged at a very low figure. On comparing with steam engines, the results are even more in favour of the use of gas in the case of engines up to 50 brake horse power. Above this, coal gas has to reckon with producer gas, which is produced at a very low cost; but being of lower calorific value, it is useful for power purposes only. Mond gas and other producer gases, owing to their low heating efficiency (which is only 120 B.T.U.) and to their unsuitability for domestic purposes, will only be rivals of coal gas so far as power is concerned; and if coal gas could be sold at from 1s. 6d. to 2s. per 1000 cubic feet, it could hold it own even here.

Year by year engineers are seeing how necessary it is to meet the competition both of electricity and of producer gas; and to do this recourse has been had to the reduction of the quality of coal gas so as to make it suitable for all purposes. Some years ago it was a surprise to find so many Scottish gas managers in favour of reducing the quality. Now it appears that even the consumers are agreeable that this should be done—judging from the little opposition that was raised when the question was brought before the town councils of some of our largest cities in Scotland. And considering that gas for cooking, heating, and incandescent lighting has advanced so much in public favour, no wonder there is a desire for cheap gas, apart altogether from quality. I hold there is a great future for gas; and that if ever the smoke question is to be solved, it will be by the use of gas in the factory and in the homes, for power and heat.

You will observe that there is a strong movement afoot in favour of greater freedom from law restrictions in the selling of gas, especially in respect to the illuminating power. Many gas companies, particularly in England, are chafing under these restrictions, which are greatly hampering their progress. The powers that be have become so familiarized with the idea that gas is used for illumination only, that they fail to realize how much it is now employed for other purposes. What is wanted is a high flame-temperature, not a high illuminating power gas—a gas that will give the best results for all purposes. Some alteration in the law will have to be made, and that soon. Professor Lewes gives very sound advice to consumers when he says: "I cannot do the consumer a greater kindness than to impress on him the fact that the efficiency of the light which he obtains and the healthfulness of coal gas as an illuminant entirely depend upon himself. By means of the incandescent burner, more light at a less price, and with less vitiation of the atmosphere, can be obtained than by any other form of combustible illuminant. Light for light, candles and oil lamps use up much more oxygen than coal gas does." The above, which is the opinion of an eminent man, ought to convince of their error the many who seem to think that gas has a tendency to vitiate the air of a room in which it is used.

It is a pity that all consumers could not be persuaded to use incandescent burners. Mantles are now made of more durable quality, and they can be obtained, burner and all, at a moderate price. Only by the use of this burner can consumers derive the true value of the gas they burn. Let it be known everywhere that incandescent lighting purifies the air of a room by promoting ventilation.

Testimonials in favour of gas as against electricity for street lighting are continually appearing. Gas companies carrying on business in towns in which the local authorities are the owners of the electricity works have, however, very great difficulty in making any headway regarding street lighting. It is natural, of course, that such local authorities should endeavour to make as effective a show as possible of their pet scheme—a scheme which it has probably cost the ratepayers an enormous sum to carry out. In many places incandescent street lighting is pooh-poohed because the corporation, in the exercise of their powers, push the sale of current independently of the question of economy or of the efficiency of the light. Many towns and cities have grown alarmed at the increased cost of lighting the streets with electricity, and are directing their attention to incandescent gas lighting, which is certainly cheaper and better. Many of you would read the report of Councillor Bruce Murray on the lighting of Glasgow streets. In the past, the side streets of Glasgow have been poorly lit. In his report, Councillor Murray said that Glasgow was behind as far as street lighting was concerned, and indicated from information obtained that, in comparison, Berlin, Vienna, and Paris, where incandescent gas lighting is extensively used, have their streets brilliantly lighted. Liverpool, Newcastle, Cardiff, and other towns were also mentioned. In Liverpool, he said, the illuminating power of the lamps throughout the city had increased from 466 million candles to 1576 millions—a fourfold increase; and yet the charge for gas had been reduced by £1302. As a result of their investigations, the Glasgow Corporation Gas Committee recommended the entire discontinuance of the use of flat-flame burners and the adoption of incandescent gas lighting—the initial cost of the installation to be £21,644, spread over eight years.

In Barrhead, I am pleased to say, incandescent burners have been fixed on all our lamps. For this, our Commissioners deserve credit. The breakage of mantles has been a serious question and has given rise to much discussion; but the cause is not far to seek. The old lamps were made to do for the new light, and they were neither wind, dust, nor water proof. This is being remedied by the substitution of well-made lanterns, and the result, so far, has been very satisfactory. Mr. Bruce Murray, in his report, says: "Any attempt to use incandescent gas otherwise than in the most approved form of specially constructed lantern is doomed to failure; and, further, if the best results are to be obtained, a staff of men must be trained for the maintenance of burners and mantles." These are two very important statements, and contain all the guidance that is needed to make street lighting by gas successful.

Mr. W. B. M'Lusky (Perth) asked the members to accord a very hearty vote of thanks to the President for his excellent address. They were debarred from discussing the address; but they should take the earliest opportunity possible of altering their procedure in this regard. It was a great pity that such a valuable contribution should pass without some comment. There were many points in it which would have been of great value if they could have got the views of the members upon them. He did not think they had for a long time had an address so full of controversial matter; and it was very creditable to the President that he had managed, within such a short space of time, to review so many important details. The President was rather pessimistic on some points. He said that gas, if sold cheaper, could hold its own against electricity; and if they would excuse him, he might take a little license with regard to this point. He would say that gas lighting was holding its own, and had all along held its own; and that it had never had its due. That gas had been holding its own all along, had now been admitted. Local authorities were bound to confess that electricity was extravagant; and the ratepayers were demanding gas, as the more efficient and the more economical of the two for the lighting of the streets. The finest example they had had of the ornamental, rather than the useful, method of applying electricity was found in St. Andrews, where the previous evening they had some three or four electric lamp-pillars as danger-signals, with paraffin lamps hung upon them. This was about as good a demonstration as anyone could desire as to the inconsistency of electric lighting. There was another point in the address he would like to call attention to—in regard to day pressure. The President had touched a very important point on the increase of day pressure having reduced leakage. In former years when the day pressure was from 5-10ths to 10-10ths, it was a very difficult matter to discover leaks. It was necessary to send someone round in the evening, when the pressure was on, and to chalk-mark the kerbstone, so that the leak might be discovered in the morning. The President had displayed great skill on this point.

The President thanked the members for the very patient hearing they had given him, and for their hearty response to the vote of thanks proposed by Mr. M'Lusky.

The Question of Affiliation.

The President, at a later stage, recounted what had been done by the Committee in the matter of the affiliation of the Association with the Institution of Gas Engineers, and asked the members to give their opinions upon the subject.

Mr. W. Blair (Helensburgh) said he would like to know, in connection with the affiliation question, if there was to be any advantage to the members of the North British Association if they did affiliate, and, if they did not, whether there would be any disadvantage to them. Did it affect them individually or as an Association in any way? If the President could enlighten them as to these two points, it might help them to come to a more careful decision on the question.

The President thought that no opinion could be given upon the points named. They should just say whether they were now to affiliate or not. He would move that they do not affiliate. Perhaps they might not expect unanimity upon the question. It would have been better if the Institution of Gas Engineers had

shown a little more tact in drawing up the terms of affiliation. The alteration they made at the end of last year, at a special meeting, he could not allow entirely disposed of the objection the Association had to affiliation. To omit the word "District" before "Association," and to retain it before "member" seemed to him certainly distasteful to many members of their Association, and was, although he did not say intentionally on their part, a personal reflection against their Association as a National Association. It was absurd, on the part of the Council of the Institution, to cling so tenaciously to the word "district," when the word "affiliated" before the words he had mentioned would have met their objection to a very great extent. "Affiliated Society," and "affiliated member," would have been much better than "associated district," and "associated member." He remembered that last year those in favour of affiliation said that, if they joined the Union, they would have one strong Association representative of the gas industry. Well, he used to think this was true—that union was strength—but he happened to be a member of the United Free Church of Scotland. But he need not go any further. Then they were to pay five guineas for affiliating. This did not seem a very large sum; but what were the privileges they were to receive for the five guineas? They were to have the privilege of affiliating—they were to have the privilege, as members of the Association, of joining the Institution of Gas Engineers, *minus* an entrance fee, and that privilege was to remain open for one year after affiliation. Then, thirdly, they were to be at liberty to appoint one of their number a member of the Council of the Institution; but this one must be a member of the Institution. They were not to be allowed to appoint anyone they liked, though they were paying a fee. He did not think that this was altogether right. They should be allowed to appoint anyone they chose, so long as they paid the five guineas. Probably they would hear something about proportional representation; and he held that they ought to have more than one representative from their Association. It was a large Association compared with many others; and if they appointed one Scotchman to go among so many Englishmen, his would be like a voice crying in the wilderness—he would never be heard. He might say he could see perfectly well where the Institution of Gas Engineers were to benefit, both in membership and otherwise; but he did fail to see what benefit they were to have. These were his reasons for moving that they do not affiliate.

Mr. J. M'Gilchrist (Dumbarton) had very much pleasure in supporting the President's motion. He thought they had wasted time in discussing such a trifling matter; and he hoped the members would take it to heart, that they had already decided, not only as a Committee but as an Association, that they would have none of it. These repeated applications to join the Institution, where they could give them no benefit, seemed absurd and idle.

The President said there was no amendment; and he would say the motion was carried unanimously.

The announcement was received with loud applause.

Election of Office-Bearers.

The President announced that, as the result of the ballot, the following had been elected office-bearers for the ensuing year:—

President.—Mr. W. B. M'Lusky, of Perth.

Vice-Presidents.—Mr. Lawrence Hislop, of Uddingston, and Mr. W. M'Crae, of Falkirk.

Members of Committee.—Messrs. J. Ballantyne, of Hamilton, W. Currie, of Alexandria, and J. M'Gilchrist, of Dumbarton.

Secretary and Treasurer.—Mr. R. S. Carlow, of Perth.

Auditor.—Mr. R. B. Main, of Glasgow.

Next Place of Meeting.

The ballot also fixed that next year's meeting should be held in Edinburgh.

Votes of Thanks.

The President, at the close of the meeting, asked the members to give a vote of thanks to the readers of the papers. The authors, he said, must have devoted a considerable amount of time, labour, and research to their preparation, and they had produced interesting and instructive papers.

Mr. W. B. M'Lusky reminded the members of their indebtedness to the University authorities in allowing them to meet there; and he asked them to convey to the proper quarter, through their esteemed friend Mr. Hall, their sense of the great kindness which had been shown them.

Mr. Hall said he would be very pleased to convey the thanks of the Association to Principal Donaldson, who very kindly and very willingly made them welcome, not only to the hall, but to all the buildings in the College, including the Museum. He hoped they would find it worth their while to come to the city. In St. Andrews they were invested with electric light. When it was introduced, the Town Council, some of the members of which were connected with the Gas Company, sat still, as they thought, being interested parties, it was not for them to do anything to retard the progress of the electric light. There was no opposition; and now with their Act of Parliament the electric light people went here, there, and everywhere. They were not doing very much. The Council had paid for the erection of four pillars in the streets; but the electric light people did not keep the lamps lighted all night. The result was that the Gas Company put up their light whenever the electric light was put out.

Mr. J. W. Napier proposed a vote of thanks to Mr. Carlow, the energetic Secretary of the Association. In Mr. Carlow they had a personality they would be very loth indeed to lose.

The President wished to concur in the vote of thanks, and to add his testimony to what had been said by Mr. Napier.

Mr. Carlow returned thanks. The position, he said, was no sinecure; but he could assure them he had always the interests of the Association at heart; and, so long as he was Secretary, he should do everything that lay in his power to make their meetings and everything else a practical and financial success.

The President's Medal.

Mr. D. Robertson, as Past-President, handed the President's Medal to Mr. Carmichael. He congratulated him upon the successful meeting which had been held in his native town, and on his having the pleasure and the honour of having on the platform beside him his honoured and esteemed master, Mr. Hall.

The President returned thanks. They had, he said, had a pleasant, and he hoped a profitable, meeting.

The Dinner and Drive.

The members and friends, including a large number of ladies, dined together in the evening, in the Cross Keys Hotel—Mr. Carmichael in the chair. There was a company of about 120 present, which was within one or two of the number at the dinner in Glasgow last year, and in Ayr in 1903.

On Friday forenoon the party were photographed in the quadrangle of the College. Afterwards they were conducted round the principal sights in the historic city, visiting the Cathedral, the Castle, St. Leonard's Chapel, the University, the Town Church, and the Links. After lunch in the Cross Keys Hotel, they went for a drive. During the two days the weather was most beautiful; and it was with regret that the members parted at the end of so happy a gathering.

USE OF CEMENT FOR PIPE-JOINTS.

The reading of the paper on this subject by Mr. J. D. von Maur, of St. Louis, at the meeting of the Western Gas Association, and given in the "Journal" last week (p. 178), led to an interesting discussion, some points of which we reproduce.

A communication was received from Mr. Ralph Woodward, of Pittsfield (Mass.), in the course of which he expressed the opinion that the cement joint was the one for gas undertakings to use. He said this after an experience extending over twenty years, using these joints almost exclusively. Any good portland cement might be employed; but he had used with much success the Orchard Roman cement (an imported Scotch brand), for the reason that it was very quick-setting, and was not quite so hard and brittle when set as some American portland cements. It was, however, so quick-setting that during hot weather he had to mix a certain proportion of portland cement with it to get the best results. This communication was followed by a few remarks by Mr. A. E. Forstall, who said that Mr. von Maur had not answered the objection raised to the use of cement joints in the business portions of cities. There would always be more breaks and more leaks in this part of a city than in any other, no matter what joint was used in laying the mains; so that the fact that there were more leaks in the business part of St. Louis, and that these leaks were on lead-jointed mains, was not conclusive as to the advisability of using cement joints unless a comparison was made between lead and cement in that place. Similarly, where Mr. von Maur spoke of it as being the accepted opinion that cement should not be laid in soft places, he (Mr. Forstall) did not think the author had answered the objection as he (the speaker) understood it. The difference between a pipe laid with lead joints and one laid with cement joints in case of settlement was that the former would give and make a number of small leaks, while the latter would not, but the pipe would ultimately break and make a large leak. So that the question as to the advisability of using cement joints or lead joints in places where leaks were apt to occur, depended upon whether it was better to have a number of small leaks or one large one, which, while it would be detected more quickly, was more apt to cause trouble than the smaller leak before it was detected.

Mr. Paul Doty followed, and said his experience accorded with that of Mr. Forstall. He had felt that in business sections of the city, where they were specially liable to have disturbance, it was better to use lead joints, for the reason that, while they might have a number of small leaks, they would not be so dangerous. A cement joint, being rigid and tight, was very liable to break the main in case of a disturbance in the street, and they were very apt to have from the breakage of the main a dangerous leak, which might cause an explosion; whereas with the lead joint the leakage was not likely to be very serious at the moment. When referring to Mr. Brownell's tests, in his "Electrolytic Survey of the City of St. Louis," Mr. von Maur said they showed that a cement joint had a great advantage over a lead one from a purely

electrolytic standpoint. Mr. Doty said he should like to ask the author of the paper how he sustained this position. He (the speaker) thought it was generally recognized that cement was practically a non-conductor; and while lead was not a good one, it nevertheless was one. As he understood the theory of electrolysis, the danger to the pipe came where the current left the pipe; and the introduction of any resistance would tend to drive the current from it. It therefore seemed to him that one would have the current leaving the pipe at every joint, carrying with it the iron, and so destroying the pipe. With the lead joint they did not have this tendency to a like extent. Therefore, in his opinion—and he thought it was the one generally accepted—the lead joint was the better one to use as a safeguard against the dangers of electrolysis. This being so, he should like the author of the paper to sustain the position he had taken up as to the cement joint having an advantage over the lead joint from the electrolytic standpoint.

Mr. T. D. Miller said he thought Mr. Doty had made a very serious mistake in his remarks on cement and lead joints so far as the prevention of electrolysis was concerned. If every joint in a main was of cement, and the resistance of the joint was very high, the electricity would not go to the main with nearly the facility that it would when the joints were lead and were better conductors. The introduction of an occasional joint of high resistance would have a tendency, in the ordinary run of the pipe, to attract the current for this run, and then leave the pipe; but where one had practically non-conducting joints every 12 feet, the chances were that the current would not go to the pipe at all, because resistance along it was much greater than the ground itself, or perhaps than the rail in the immediate vicinity. His (the speaker's) experience of electrolysis was that as soon as they created a little better conductivity in their main, they had more current; and the bonding of the two rails to the points where the current left the pipe would have a tendency to make the pipe take more current out in the sections of the city where it was going through the pipe. Wherever it struck a joint of high resistance, it would create damage. Therefore he believed that universally the use of cement joints would have a tendency to reduce electrolysis throughout the entire system of mains. The question of using cement joints as against lead ones in soft ground, because of the protection and elasticity of the lead joints, had been raised. They would be barred from using cement joints entirely in New Orleans, if this were the case. The entire system of mains in the city was laid on 2-inch plank, to act as a sort of float to hold up the pipe. It was true the tendency to break was greater; but where there was so much soft soil, the foundations were so poor that there was usually a good deal of water. A bad break of a main where there was a good deal of water, or a break of any kind, unless there were a very high pressure, would have a tendency to let the water into the main instead of the gas out. This was one of the troubles they had to contend with. It was not gas leaking out of the mains, but water leaking in. Mr. Miller added, in answer to a question, that there were a great many lead joints in New Orleans.

The next speaker was Mr. Fullerton, of Schenectady, who said he used cement joints exclusively, and did not allow for expansion or contraction. They used 5-inch sockets. Last summer they had occasion to lay 1600 feet of pipe in a place where they had to sheet-pile the whole length of the trench, and the bottom was very soft—in fact, a kind of quicksand. They placed 2-inch planks, about 2 feet long, for blocking under the ends of the pipe; and it gave no trouble. To stop the water from washing the cement off the joint, they tore cement bags in half, doubled up the half, filled it with dry cement, wound it round the joint, and tied it there. These joints (of cement exclusively) had not given any trouble since. For three years they had had no broken mains with cement joints in Schenectady; but in Buffalo they had a number with lead joints.

Mr. M'Adam said he thought it was very evident, from the figures given in the paper, that cement joints were cheaper than lead ones; but he could not see why labour should be more economical. He contended that a lead joint could be made much more quickly than a cement one; indeed, he had done it. Was Mr. von Maur figuring his labour on the unskilled basis? If so, he thought there was danger there, from the fact that these men might suddenly feel that they were skilled, after they had made joints for some time, and would demand just as much for their labour as the caulkers. This meant trouble; and if they did not get more money they would certainly put in inferior work. A poor cement joint was worse than a poor lead one. The difference in cost really ought to be in the lead, which he thought Mr. von Maur had put too high. In Milwaukee they used from 15 to 25 per cent. less lead than they did in St. Louis; and they had no trouble from leaky joints, because they were well made. In the winter of 1904-5, nearly all the main system was frozen; but they had only six broken mains, four of which were caused by sewerage, and two were cases in which the services were tapped into the mains. Only one was in the business district. At different points in Milwaukee, and within a radius of 600 feet, they had a difference of nearly 2 feet in the depth of frost. This was where expansion and contraction came in. He doubted whether a cement joint could be used to any advantage in a condition such as this. It was not the expansion and contraction of a pipe they had to contend with so much as the ground.

Mr. Haines said they had used cement joints for about twenty years in Des Moines, and he did not agree with the remarks which had been made in regard to labour. In his opinion, any intelligent labourer could make a first-class cement joint, if he was properly instructed, in a very short time. The proportions of cement to water given to the labourers could be arrived at by proper measures; and care had to be taken not to allow the cement to become partially set before it was used in the joints. He thought another point in regard to lead joints that had not been brought out was that when one was driven too hard, it placed the main under tension, and made it less flexible as it was being laid than a cement joint did. In other words, when a lead-joint main was laid, the driving up of the lead drew the entire main into tension, and when the trench was filled up, it was liable to be—and necessarily must be—more or less depressed or elevated by filling in and ramming the dirt. In the cement joint, the cement was placed in position when the pipe was bedded on its foundation, and did not draw the main into tension, and therefore it obtained a better and more even bedding than was possible under lead-joint conditions.

Replying upon the discussion, Mr. von Maur, referring to Mr. Forstall's remarks as to whether it would pay to lay pipes with cement joints in the business sections of a city, said there was only one way to prove this absolutely, and that was to try it. If they were following any certain practice, such as making joints with cement, and found it was a success throughout the city where it had been tried, and that lead-joints had not been a success, why was it not good policy at least to make the experiment and try the joint in the business sections? He added that since the paper was written he had made an experiment with a 4-inch line of pipe, with cement joints, parallel to a steam railway, and only 10 feet away from the rail. It had been in for only a few months; and he did not know whether or not they would have any trouble with it. But this line replaced a cast-iron main laid with lead joints, which leaked and broke continually. A serious accident resulted from one of these leaks, and an expensive lawsuit ensued. He had every reason to believe that the present main, laid with cement joints, would cause far less trouble than the one it had replaced. As to laying pipe in soft places, his contention was that the experiments they made showed that a pipe laid with cement joints had more elasticity than was usually supposed. In one experiment, the pipe sagged 15 inches before a leak developed; and they hardly ever had more sag than this, even in soft ground. Furthermore, they had laid in soft ground pipes which had been in use for more than two years, and there had been no trouble with them. Coming to the question of electrolysis, Mr. von Maur said he could not agree with Mr. Doty that it was the generally accepted opinion among engineers that it was better to have a good conductor than a bad one for pipe-lines. Where did the damage from electrolysis become most serious? He had always found it was a great deal more serious on the wrought-iron and steel than on the cast-iron pipes. They had in St. Louis a line of cast-iron pipe with lead joints, and thus of low electrical resistance; and yet they had found that unprotected services on this line were destroyed in about five weeks. He believed that had the main been insulated the current would have been less, and the damage correspondingly decreased. Referring to the matter of costs, Mr. von Maur said those submitted in the paper were based on actual experiments. Whether or not pipes could be laid in frost, he was not prepared to say, except that he understood that in Chicago a line of 16-inch pipe was laid with cement a number of years ago, and they had never had any trouble with it. He should judge that the frost in Chicago would reach about the same depth as in Milwaukee; and since they had no leaks in the latter city in pipes laid in the frost with lead joints, there could not be any movement of the pipe-line. If there was no movement, cement should do quite as well as lead; for it must be remembered that the main advantage claimed for a lead joint was that when the frost moved the pipe, it caused a number of lead joints to give slightly, the line not being rigid. This would result in a number of small leaks around the joint. Coming, finally, to the labour question, and the danger of strikes on account of training a large number of labourers to make cement joints, he believed the more unskilled men they trained to be expert workers, the better off they would be. Last spring they caused it to be distinctly understood that no caulker or foreman could work for the Company during the coming winter who was not able to make cement joints by December. It was surprising what a large number of good men were developed in a short time. In carrying out this policy, they practically flooded the market with men who, while not being really expert caulkers, were expert cement joint makers. This was not only a good thing for the Company, but also for the men themselves.

Scurfing Retorts by Compressed Air.—The Berlin Anhaltische Maschinenbau Actien Gesellschaft have made an addition to their patent of Feb. 24, 1903, for the above-named object. After the layer of tar and carbonaceous matter adhering to the walls of the retort has been burnt by the aid of compressed air, steam, together with air under a lower pressure, is introduced, in order (by reduction of the pressure in the retorts) to accelerate the removal of the graphite. The steam may be sent direct into the retorts, or may be produced in them from water introduced through the air-inlet pipe.

SOME ASPECTS OF THE COMMERCIAL MANAGEMENT OF GAS-WORKS.

By ALEX. YUILL, of Dundee.

[**A Paper read before the North British Association of Gas Managers.**]

In placing before you some notes on the commercial management of gas-works, I have no desire to widen my search into all the intricacies or complex problems that the gas manager oft-times experiences, but rather to confine my observations on this subject to the part which deals with the assessable value of the works, the resultant taxes based on same under burgh, county, and parish council demands, and that charge which often raises the question of our patriotism—namely, income-tax.

In considering the main question of valuation as it affects us, we are at once confronted with a most complex problem, and one which often creates in us the desire to know more of this subject, which is of so much importance in the commercial management of the undertakings which are under our command. Beginning with the historical aspect of the case, we find—as shown by Sheriff Guthrie in his "Digest on the Poor Law Act"—that prior to the year 1845 the only valuation of the hereditable property in the kingdom was known as valued rent, established by an Act of the Convention of Estates in 1643, and subsequently ratified after the Restoration in 1670. The valuation declared was to be the actual rent the landlord was entitled to draw under deduction of all permanent burdens then existing—namely, minister's stipend and schoolmaster's salary.

As no provision was contained in the Act of Convocation for revaluations, either with change of tenancy or superior, the valued rent then fixed ultimately became the merest shadow of the yearly worth of property. Not only did it not represent the actual value of real property, but ultimately many subjects were not embraced in it, such as mills, manufactories, gas-works, and other undertakings which did not exist in 1643, and which, if assessed at all, required to be assessed on a very different scale from that applied to the older form of real estate.

The inconvenience came to be so severely felt that a practice crept in of imposing rates, not on the valued rent, but on a rough annual estimate of the real rent, which system, on being challenged, was upheld by the Court as just and equitable, although no Act of Parliament then existed for such a change.

When the Poor Law Act was passed in 1845, it was enjoined (under the 37th section) that in estimating the annual value of lands and heritages the same shall be taken to be the rent at which, one year with another, such lands and heritages might, in their actual state, be reasonably expected to let from year to year, under deduction of the probable average annual cost of the repairs, insurance, and other expenses, if any, and all rates, taxes, and public charges payable in respect of the same.

Prior to the passing of the Valuation Act of 1854, all the various bodies charged with the imposition of rates under municipal, poor law, and county, &c., were all required to have a valuation of their own prepared, frequently with no sufficient data, and often exhibiting results of an entirely contradictory character. The Valuation Act of 1854 put an end to all this by establishing machinery for the preparation in each county and burgh of one valuation roll (compiled by assessors) by which all the taxes imposed by poor-law authorities, burgh, and county are regulated.

Section 6 of the Act states that the yearly value of lands and heritages shall be taken to be the rent at which, one year with another, such lands and heritages might, in their actual state, reasonably be expected to let from year to year (without any deductions, as noted in the 37th section of the Poor Law Act previously referred to).

Under the 23rd section of the 1854 Valuation Act, it is enacted that any water company or gas company or other company having any continuous lands or heritages liable to be assessed in more than one parish, county, or burgh, may make intimation to the sheriff of the county of their desire to have their works placed under the jurisdiction of the Railway Assessor before the 15th of May in any year. In 1894, the latter date was altered to the 15th of November—chiefly for departmental reasons.

As we have had under review both the inception and the evolution of the system of rating, I will next deal with these taxes in details, and more especially the system of valuation which is now more or less stereotyped by decisions given in disputed cases by the Court of Session from time to time, and which cases, no doubt, arose mostly through ignorance or misinterpretation of the above-recited rating clause. These decisions now guide and assist in determining the true assessable value of any gas-works, whether owned by town councils or by companies.

The assessable value of a gas company, like that of a water company or railway, is determined on the basis of the profits made. It is now recognized as determining the valuation (as was settled in the Dundee case in 1881) that a gas-works in the hands of a company is entitled to a deduction off the net valuation of 20 per cent. for tenant's profits, which is denied these works under a corporation, on the plea that they can never earn for themselves anything analogous to tenant's profits, owing to their requiring to sell gas at the cost of manufacture. The latest rating decision is the Kirkcaldy case, where the Company obtained an increased sum of £10,400 as a deduction for tenant's capital—representing capital expended by the hypothetical tenant on meters fixed in consumers' houses. This is in conformity with the custom prevalent in England. As the Kirkcaldy case is the last decision, an example of the assessable computation may be given as authoritative, and is based on their balance-sheet for the year 1903-04 :—

Revenue.

Sale of gas	£18,077	14	3
Sale of coke and tar	3,285	13	4
Miscellaneous revenue	9	1	10
	£21,372	9	5

Expenditure.

Coal	£9,283	4	8
Lime	291	8	9
Wages applicable to manufacture of gas	2,466	17	6
Repairs and maintenance of works	1,337	17	6
Tenant's rates and taxes	584	6	0
Directors' fees	50	0	0
Wages applicable to distribution of gas	624	6	0
Stationery and printing	82	2	7
General establishment charges	380	4	10
Auditor	20	0	0
Interest paid by Company	152	13	0
Bad debts	70	19	8
	£15,343	10	6

Revenue, as above	£21,372		
Expenditure ,,	15,343		
	£6,029		
Add fractions forward	1		
	£6,030		
Deduct 5 per cent. interest upon £15,000, being £4600 for ordinary capital and £10,400 expended on meters	750		
	£5,280		
Deduct 20 per cent. for tenant's profits	1,056		
	£4,224		

The above sum of £4224 represents the assessable value of the Kirkcaldy Gas-Works for the year 1904-5.

Had the gas-works belonged to the Corporation, and the revenue and expenditure been similar to the above, the assessable value would have been £5280. As is previously noted, corporations are not entitled to a deduction for tenant's profits. In the foregoing, it will be seen that no entry appears for meter charges in the receipts column, as it was previously decided that the income from this source is required to cover the depreciation on same.

I am conscious that the system adopted in Scotland differs in some details from that ruling in England. More especially is this the case in the items claimed as working capital, as is noted in Newbigging's book on "The Principle and Practice of the Valuation of Gas, Electricity, and Water Works for Assessment Purposes," which commends itself to any student of this abstruse subject.

In considering the question of deduction from the valuation for tenant's capital, it is now recognized that the sum previously allowed is quite inadequate, and not in keeping with what gas companies or corporations are entitled to. In the past, assessors defined tenant's capital as analogous to the trading capital of a merchant—independent of the value of his stock-in-trade. As hypothetical tenant, he is entitled to what the merchant would designate as the total sum he has invested in the concern, such as value of stock and money necessary to carry on his business.

The items which comprise deductions from valuation for tenant's capital may be put as under :—

(*a*) Working expenses (recognized as 5-12ths of net annual expenditure).
(*b*) Value of six weeks' stock of coal calculated at the maximum daily consumption.
(*c*) Meters on hire and in stock.
(*d*) Tools, implements, and office furniture.
(*e*) Sundry stocks.
(*f*) Coal waggons and other movable plant.

In the Kirkcaldy case, it was held that the value of cooking-stoves could not be included as a deduction under tenant's capital.

When we come to consider the Poor Law Assessment, we at once realize that further study is required; the procedure after the assessable value is declared being entirely different from that adopted in the imposing of burgh or county council rates. I have no desire to go into, or follow, all the intricacies of the various classifications which may be adopted by the parish council in imposing its assessments under the Poor Law Act of 1845. After receiving a copy of the valuation from the assessor, they proceed to impose their assessment under whatever classifications they may have adopted. This power of classification is, however, not to be confounded with the provisions of the 37th section, relating to deductions; and, according to Sheriff Guthrie, the assessment cannot be imposed on the gross value as entered in the valuation roll, but only under deduction of the probable annual average cost of repairs, insurance, and other expenses (if any) necessary to maintain such lands and heritages in their actual state, and all rates, taxes, and public charges payable in respect of the same.

Thus, whether a system of classification is adopted or not, the parish council, before imposing an assessment, requires to make up an amended roll, as it were, in which the assessable rent is specified.

In some parishes a practice has prevailed of making the assessment direct from the valuation roll; no deductions from the gross rental being allowed at all, or deductions being allowed only with respect to certain descriptions of property and particular classes of ratepayers. But it has now been decided that these different methods are all illegal. The Poor Law Act gives no authority for imposing an assessment otherwise than in accordance with the 34th section; and where the percentage allowed to cover these deductions is insufficient, a ratepayer may have relief, if not able to settle amicably with the parish council authorities, by a suspension in the Court of Session.

The word "repair" occurring in the 37th section has been defined to mean the restoration of a subject to a sound state after decay, injury, delapidation, or partial destruction. It does not mean the reconstruction of the subject by the removal of part of it, and its reproduction in a new style.

According to the decision given in the Court of Session, in the action raised by the Glasgow Gaslight Company in 1863, they were found entitled to a deduction on account both of the depreciation of their works generally, and of the cost of repairing and replacing their gas-meters; for without such renewals their works would have come to a standstill.

I found a short time ago, when considering the assessment made by the Parish Council, that the 20 per cent. deduction from the valuation was not a sufficient one to cover depreciation on buildings and plant not chargeable against revenue. I therefore prepared and placed the whole particulars of our case before the Parish Council, with the result that we were allowed an extra 5 per cent. as deduction—making, in all, 25 per cent. off the assessable value as noted on the valuation roll.

As a statement of our claim may be of interest, I append it.

Assessable Valuation as Undernoted.

Period.	Amount of Assessable Value.	Deduction Per Cent.	Amount Allowed.
For year 1899–1900	£25,929 12 8	20	£5,185 18 6
,, 1900–1901	23,009 4 5	20	4,601 16 11
,, 1901–1902	19,878 17 9	20	3,975 15 6
,, 1902–1903	30,338 10 1	20	6,067 14 0
,, 1903–1904	28,171 5 6	20	5,634 5 1
Net allowance			£25,465 10 0

Valuation of Buildings and Plant Depreciated and Substituted by New Work.

Old retort-house, retort-benches, and coal-stores	£11,510
Old exhauster-house, meter-house, governor-house, weigh-house, lavatories, and bath-room	1,265
Old chimneys	1,100
Scrubbers, exhausters, condensers, and governors	3,413
Old railways	940
Boilers	1,050
Piping in works	1,400
	£20,678

Claim by the Commissioners for Deductions from Poor Rates, &c.

Statement for the last five years, showing the actual expenditure for repairs, insurance, rates, taxes, &c., for which they are entitled to get a deduction under section 37 of the Poor Law Act, 1845:—

Year to April 30, 1900—	
Owner's rates, taxes, and insurance	£1,981 3 1
Year to April 30, 1901—	
Owner's rates, taxes, and insurance	2,293 13 5
Year to April 30, 1902—	
Owner's rates, taxes, and insurance	2,310 16 10
Year to April 30, 1903—	
Owner's rates, taxes, and insurance	1,890 11 1
Parliamentary charges	2,072 13 6
Year to April 30, 1904—	
Owner's rates, taxes, and insurance	2,863 11 7
Total	£13,412 9 6
Depreciation of buildings and other heritable property, as per list, amounting to	£20,678 0 0
Net total	£34,090 9 6

Summary.

Valuation of buildings and plant depreciated and substituted by new work, as per annexed statement	£20,678 0 0
Amount of owner's rates, taxes, and insurance for five years to 1904, as per statement	13,412 9 6
	£34,090 9 6
Deduct sum allowed as depreciation by Parish Council, in terms of section 37 of the Poor Law Act, 1845, during the above period, as per statement	25,465 10 0
Net depreciation claimed off assessable value	£8,624 19 6

With the view of explaining the reasonableness of our claim as noted above, let us suppose "A B" has a property the assessable value of which is entered on the valuation roll at £100. This entry may have gone on for years without any change; and on this "A B" pays his share of taxes as landlord. His tenants also pay their share as occupiers. A time may come, or circumstances may arise, which necessitates the removal of this property. It is at once removed from the valuation roll; and the assessor knows it no more.

Now let us take a property or buildings connected with a gas-works, the first cost of which is debited to capital. As interest and sinking fund require to be raised from revenue to meet this capital charge, the assessable value is raised accordingly. After a time, the same contingency may arise as in the above case, when the site occupied by these buildings may be required for extensions or otherwise. Although the property in question is *non est*, the same profits as formerly require to be raised to meet the fixed charges; no allowance being given in the assessable value for the demolition of the buildings in question.

The 37th section of the Poor Law Act empowers parish councils to give relief in cases such as this. The onus, therefore, lies with individual companies or corporations to insist on such deductions should the allowance they give from the valuation assessment be inadequate to compensate them for such loss. The same relief is required by all companies or corporations where assessable value is determined by the difference between income and expenditure, for burgh rates and county council charges.

As to income-tax. In computing the sum chargeable for it, the formula adopted differs somewhat from that for valuation purposes. For income-tax purposes, deductions are allowed for taxes, whether for landlord or tenant, together with a sum representing insurance of works and plant. Feu duties are not allowed as a deduction from profits, owing to the right of deduction of income-tax by the landlord before payment to the superior. Income-tax payment is also deducted, as the major part is retained by the corporation from those parties when paying interest on loans, and in the case of some companies from the dividends paid to shareholders.

A question has often been raised by companies whose profits are less than £700 whether they are entitled to deductions, as abatement, on the same scale as is given to individuals. This point has now been settled, on the initiative of the "Gas World" a short time ago, in a communication they made to the Inland Revenue Department, Somerset House, in the reply to which it was made clear that no such deduction or abatement will be allowed to companies. It was, however, pointed out by the department that, in accordance with the Income-Tax Act (5 and 6 Vict., cap. 35, sections 163 to 170), individual shareholders possess the right to reclaim the tax, the loss of which they may have suffered by deduction from dividend, in the event of their total income not exceeding £160.

Deductions as depreciation of machinery and plant open up a wide field of study, and one which necessitates more attention than is often given by those immediately interested. Section 12 of the Inland Revenue Act, 1878, states that "the Income-Tax Commissioners shall, in assessing the profits or gains under Schedule D, allow such deductions as they may think just and reasonable as representing the diminished value by reason of wear and tear during the year of any machinery or plant used for the purposes of the concern." Before deductions under the above section can be claimed, it is advisable to have an interview with the assessor, when no difficulty need be experienced in arriving at an amicable arrangement on a just and equitable basis applicable both for immediate and future computations. Undernoted is a form of computation approved of by the assessor.

1.—*Return to the Property and Income-Tax Commissioners for the Year* 1904-5.

Income—		
By sale of gas	£92,018 13 6	
Residual products	21,094 15 11	
Gas-stoves	332 4 9	
Other revenue	654 15 0	
		£114,170 9 2
Expenditure—		
Manufacture of gas	£68,733 11 2	
Distribution of gas	7,854 0 7	
Rents, rates, and taxes	7,313 9 6	
Management and other charges	3,363 3 3	
		87,264 4 6
		£26,906 4 8
Add—		
Feu duties	£315 6 8	
Income-tax	1,036 16 5	
		1,352 3 1
		£28,258 7 9
Deduct—		
Assessable value of subjects separately charged		274 3 0
		£27,984 4 9
Less depreciation, as per list No. 3		4,102 19 0
		£23,881 5 9

2.—*Valuation as at April* 30, 1904.

	Percentage Deductions as Undernoted.		
	At 2½ Per Cent.	At 3 Per Cent.	At 5 Per Cent.
A, as undernoted	£50,925 9 11		
B, as undernoted		£40,229 6 6	
C, as undernoted			£21,394 14 7
Valuation at April 30, 1903	50,925 9 11	40,229 6 6	21,394 14 7
Added during year 1903	1,658 4 10	7,388 15 6	5,801 13 2
Value at April 30, 1904	£52,583 14 9	£47,618 2 0	£27,196 7 9
Less depreciation allowed off income-tax return for year 1904-5, as undernoted	1,314 11 9	1,428 10 10	1,359 16 5
Net value at April 30, 1904	£51,269 3 0	£46,189 11 2	£25,836 11 4

3.—*Depreciation.*

(*a*)	£52,583 14 9	at 2½ per cent.	. . . . .	£1,314 11 9
(*b*)	47,618 2 0	,, 3 ,,	. . . . .	1,428 10 10
(*c*)	27,196 7 9	,, 5 ,,	. . . . .	1,359 16 5
				£4,102 19 0

4.—*Classification of Deductions.*

A.—2½ per Cent.	B.—3 per Cent.	C.—5 per Cent.
Retort-benches.	Consumers' meters.	Hydraulic charging-machines.
Retorts and fittings.		Do. drawing-machines.
Hydraulic mains.		Do. engines and accumulators.
Annular condensers.		Coal breakers and elevators.
Scrubbers and washers.		Coal-hoppers.
Purifiers.		Steam-cranes.
Station meters.		Coke-gantry.
Governors.		Engines and exhausters.
Gasholders.		Coal-conveyors.
Carburettor.		Boilers.
Engines, pumps, &c.		Coal-waggons.
Sulphate of ammonia plant.		Locomotives.
Coal-testing apparatus.		Small coke-waggons.
		Workshop tools, &c.
		Gas-stoves.

When we make a comparison of the capital involved per 1000 cubic feet, we observe the taxes increase in the same ratio. This must necessarily be so, as any company or corporation burdened with a large capital must raise from revenue a sum to pay interest and sinking fund, which practically means an increased assessable value. An increase of taxation must be placed against the selling price of gas, which, from the subjoined table, we find amounts to a difference of 2·36d. per 1000 cubic feet between the lowest and the highest on the list. This not only affects the consumers, but gas companies who are placed under the sliding-scale must sacrifice 5s. per cent. of dividend for every 1d. of increase in the price of gas.

Comparative Table Showing Relation between Capital and Taxes per 1000 Cubic Feet of Gas Sold.

No.	Town.	Taxes per 1000 Cubic Feet of Gas Sold. d.	No.	Town.	Capital per 1000 Cubic Feet of Gas Sold. s. d.
1.	Rothesay	0·85	1.	Alloa	7 3
2.	Glasgow	0·90	2.	Glasgow	7 4
3.	Alloa	1·25	3.	Kilmarnock	7 8
4.	Broughty Ferry	1·35	4.	Rothesay	7 11
5.	Renfrew	1·37	5.	Hamilton	9 0
6.	Kilmarnock	1·59	6.	Dundee	11 9
7.	Arbroath	1·81	7.	Arbroath	11 11
8.	Edinburgh	1·81	8.	Greenock	12 2
9.	Greenock	2·17	9.	Coatbridge	12 3
10.	Hamilton	2·32	10.	Renfrew	12 8
11.	Johnstone	2·55	11.	Edinburgh	14 11
12.	Dundee	2·59	12.	Johnstone	16 1
13.	Coatbridge	2·74	13.	Broughty Ferry	17 8
14.	Perth	3·21	14.	Perth	24 8
	Average	1·89		Average	12 4

I have no desire to place before you an imaginary model or mode of computing the assessable valuation of a gas-works, with all the multifarious deductions claimed as just or equitable, but shall content myself by giving you all the particulars on the various points raised, which now bear the stamp of judicial decisions.

I have only to add that it will well repay you to make yourselves thoroughly conversant with all the particulars bearing on the points at issue, and more especially so if you are a believer in the axiom that "Fortunes are Made from Savings and not from Earnings."

Discussion.

The PRESIDENT (Mr. J. W. Carmichael), in opening the discussion, remarked that the paper was one which the members should have had in their hands weeks before, as the question dealt with was a very complex one. Probably to many Mr. Yuill had treated it in a different way from what they had expected. However, he had brought out a few points which some would probably pass over, owing to the intricate nature of the subject.

Mr. D. ROBERTSON (Dunoon) remarked that Mr. Yuill had given them so many figures that he, for one, was not able to absorb them all. Nevertheless, it was a most valuable paper; and he thought this would be realized to a far greater extent when they began to ponder over the various questions raised in it. There was nothing so galling to a gas manager who had exerted himself for a whole year as to find, at the end of that time, the tax collector come and swoop off so large a proportion of his earnings. They sometimes thought they were like Sisyphus, who was condemned to roll a stone to the top of a hill, and when he managed to get it there found it just began to roll down, and his work had to be done over again. They began on the 15th of May to make profits, and on the 15th of the following May these profits were all taken away from them. They were just like the bees, who filled their hives with beautiful honey, and at the end of the season somebody came and took it away, leaving them only what might be termed a bare subsistence. He thought Mr. Yuill was to be thanked for his paper. He saw many good points in it; but he had thrown too many figures at them.

Mr. J. M'GILCHRIST (Dumbarton) thought Mr. Yuill had gone too much into detail for the paper to be properly discussed. In his opinion, the assessors might be saved a great deal of trouble if gas managers would see that proper charges were made against revenue, rather than heaping up charges to the capital account. There were works he could name, in Scotland, where they had made extensive alterations which had been debited against capital, when perhaps more than half of the cost should have been put against revenue. He should say that 3 per cent. was far too low for the B charges—consumers' meters—and that they would save the assessor a great deal of trouble by simply, when they were renewing meters, charging the cost to revenue. To his mind, Mr. Yuill had failed somewhat in impressing upon the members the desirability of keeping down the capital account. Probably a gas manager who had made up his mind to remain in a particular works saw that the charges which should be borne by revenue were placed to it. From valuations he had made of different undertakings, he considered that a gas manager who was anxious to remove from one town to another was not so particular upon this point, but allowed charges to go to capital which properly should have been placed to revenue. Of course, it suited him, for the time being, to show that he could make great profits; but the undertaking had suffered all the same. It was not very long since he spoke of a suspense account. Would Mr. Yuill kindly let them know his objection to such an account? On the former occasion, Mr. Yuill said that the assessor would not allow it. He (Mr. M'Gilchrist) knew that; but this was because of the operations on the suspense account. In the case Mr. Yuill specially referred to, there would be no difficulty at all. If he knew that old property was to be removed, he should have begun to write off three years before, and it would then stand clear on the books, and there would be no trouble with the assessor. He thought, however, Mr. Yuill deserved the thanks of the members for the work he had done in connection with the paper.

Mr. A. MUNRO (Falkirk) said that, with the permission of the meeting, he should like to make a few remarks, as such a paper as the one Mr. Yuill had given them deserved criticism. He had gone into the question of valuation with very great care, and had laid before them details of valuation, including the latest decision in the Court of Session—in the Kirkcaldy case. If gas managers were to examine their balance-sheets, on the method by which the assessor arrived at his valuation, he was certain they would find many things for which they were not getting anything like what the Kirkcaldy Gas Company had got through their case. As Mr. Yuill said, it would well repay them to make themselves fully conversant with all the points at issue. If a paper were read (say) on a modern retort-house, they would all have opinions to express, and there would be very considerable controversy. But here they had a paper which had been brought out to assist every one of them, and the opinions in it very largely disarmed criticism. Mr. M'Gilchrist very pertinently put it that there was a weakness on the part of gas officials for unduly adding to capital. This, he believed, was to a certain extent practised in Scotland; and they must know that if they added revenue charges to capital, they had, if he might use the expression, to "pay through the nose" for it in taxes. As Mr. M'Gilchrist had said, it was a practice which ought, to a very large extent, to be given up, because, if they considered for a moment what the taxes were, they must be aware that during the last ten years the rate of local taxation had very much augmented. As was recently mentioned, in one of the magazines, by that great expert in figures, Mr. J. Holt Schooling, in twenty years the rate per head had doubled itself. It started twenty years ago at 16s. 2d., and it was now more than 30s. The increase had been altogether abnormal; so much so that there had been, in some instances, associations formed to try to curb the spending proclivities of local authorities. There appeared to be no co-operation in the expenditure of departments; and this was going on from day to day. They would have recently seen from the newspapers that in Glasgow and some other towns there was to be an increase in the rates this year. It was only to be 1d. or 2d. in the pound, but it went on every year; and they could hardly instance a case where the taxation was diminishing. As Mr. Schooling very pointedly put it, it seemed to him very puzzling to know why, when so many people were going into the towns—and naturally with a rateable value—the rate of taxation increased instead of diminished. This appeared to be the penalty of the age they lived in. They ought to study the Kirkcaldy case, make a careful note of it, and compare it with the assessor's valuation of their own gas-works. They would find that, instead of being allowed 5 per cent., it was only 4½ per cent., and that the tenant's capital, instead of being £15,000, as allowed by the Court, would be £17,000. The Court granted £15,000 in the Kirkcaldy case, which was roughly 80 per cent. If they examined the tenant's capital, they would find that this was nothing like the proportion; and hence they should claim from the assessor a deduction on this point. Mr. Yuill, as it were, took the bull by the horns, and went to the assessor and demanded a deduction; and he got it. He secured a considerable deduction on his poor-rates—a very respectable sum. Mr. M'Gilchrist said that, instead of putting to capital the cost of extensions, they should put it to revenue. This brought out very fairly the difference between what was legal and what was expedient, because they must recollect that they had an assessor to deal with. If they put repairs into the revenue account, the first thing the assessor would say would be, "Where do you get this figure?" and it would take a considerable amount of argument to convince him that they were legitimate repairs. Where it could be shown that renewals were simply renewals, or replacements due to the obsoleteness or waste of any machinery or buildings, they would be justly entitled

to enter them to revenue; but they must be prepared to argue the point with the assessor. It did not do to go before him with only a smattering of the subject. They must know their points; and, if they did, they could make a very considerable difference, because if they took the case (say) of Forfar, the taxation there was roughly at the rate of 10s. per £1; and for every pound they allowed the assessor to put on to their valuation, they had 10s. of taxes to pay. He was certain the subject of taxation did not have the attention it ought to receive. If they took the time to make a careful study of the figures given in the paper, they might get what had been obtained in Kirkcaldy; and they would be getting their just rights.

Mr. M'Gilchrist said he should like to ask Mr. Munro to consider whether the assessor knew the value of an undertaking, or what was required to maintain the fabric, better than the manager was supposed to do.

Mr. W. M'Crae (Falkirk) thought the members were much indebted to Mr. Yuill for bringing the subject of his paper forward, because at the present time the method of taxation affected them very much indeed. It was all very well to speak of the assessor being the best judge of what assessment he was to fix. They had found, from experience, that they were entitled to a certain abatement on their taxation, and they did not get it. Taxation had absolutely increased to a very large extent; and this being the case, it considerably affected their balance-sheet. This had been brought home to them very clearly at Falkirk, where they had found that they should have had a very large rebate on their poor-rates, but did not get any until they had used some pressure, when they obtained a rebate which would mean a reduction to them of £700 a year. He thought, with Mr. Munro, it would well repay them to look after the taxation, because it affected the balance-sheet, and this affected the manager.

Mr. W. B. M'Lusky (Perth) said in Perth they had benefited from Mr. Yuill's research. Some months ago they had under consideration the question of the depreciation on their old works, and it happened that at the time Mr. Yuill had the details of his research; and he (Mr. M'Lusky) had the advantage of a perusal of his figures. They made a claim on the basis of the Dundee returns, and they expected to get a rebate on their Parish Council assessments. Mr. Yuill had drawn attention to the influence of the excess of capital expenditure on local taxation. In Perth, during the past five years, owing to the erection of new works, and thoir consequent better and cheaper working, the gross profits earned had risen from £5000 to £13,000 per annum. They could understand that this increase of £8000 per annum on the gross profits meant a somewhat serious augmentation, not only of income-tax, sinking fund, and other charges, but also of local taxation. If the taxes paid were all going to the Local Authority, then, from an economic point of view, there would be no loss to the citizens; but, unfortunately, in their case, the new works were not situated within, but outside, the parish of Perth, and a considerable proportion of their taxes were paid over to the county. In other words, the ratepayers of Perth were not getting any benefit from the large expenditure upon the new works. If all their increased taxation contributed to Perth itself, the contribution of the Gas Department would have brought down the local taxation by 3d. in the pound; and they could understand that so handsome a contribution would enable the Corporation to undertake schemes which at present they did not feel justified in proceeding with. During the first year of the operation of the new gas-works, the Parish School Board were able to reduce their rates by 1d. in the pound, owing to the contribution from the gas undertaking. It thus appeared that an increase in the capital outlay rather helped one department but weakened another. As to the allocation of expenditure between the revenue and capital accounts, he had always found that the auditor was very careful to satisfy himself that the charges were all of them properly allocated. In regard, for example, to meters and stoves, he examined the working accounts to see whether the meters which had been displaced by new ones had been removed from the capital account; and their practice was to make out this account simply as debit and credit, charge and discharge—to show the meters removed and their original value, and the meters placed and their original value. They would find that when they removed an old wet meter and fixed a new dry one, the value of the new meter was considerably less than that of the old one removed. In some cases it had been found to be sufficient to simply pay for a new meter out of revenue. But it was not enough to pay for the new meter, they must deduct from capital the excess value of the one removed. In his own case, he might fix £500 worth of new meters in a year, and have to deduct £700 from the capital account, because the value of the wet meters removed was considerably more than that of the dry ones placed, notwithstanding that the capital value of the dry meters was greater than that of the wet ones. With regard to stoves also, it was necessary to pay all the expenses for the tubing and finishings used in fitting, because if the stove were removed the value of the labour expended in fitting it up would be quite destroyed. Mr. Yuill had given them a very valuable contribution; and when they had time to study it, he was sure a great many of them would derive benefit.

The President remarked that Mr. Yuill had brought before them in his paper a great deal of very useful information, the compilation of which must have entailed considerable trouble and research. He had dealt with a most complex question, and had made it very clear. He had no doubt that the Kirkcaldy case would be to the profit of a large number of gas companies, because he believed they would demand the deduction for meters which the Company there had been allowed. He could not say that the question affected Barrhead, because they were not the owners of the meters; they belonged to the consumers. Another point Mr. Yuill had mentioned was that of the depreciation of buildings and plant. He thought they very often forgot this, and the result was that they were assessed more than they ought to be. Mr. Yuill had made this very clear in his statement of the claim his Commissioners made; and he further supported his contention by saying that the law was on their side, and that the authorities ought to give relief. In regard to income-tax, it was quite true that all companies except co-operative societies had to pay it. He did not altogether understand the comparative tables at the end of the paper; but perhaps they might be made clear. Broughty Ferry, for instance, was near the top in one column, with a taxation of 1·35d. per 1000 cubic feet of gas; but it was down at the bottom in the column showing the capital per 1000 cubic feet. He was very sorry for Perth; but he had no doubt that, with the able management and engineering of their friend Mr. M'Lusky, they would soon be able to overcome the difficulties of their present position. He had to thank Mr. Yuill for his paper. He must confess he had not gone into the subject very minutely, as he left it to their lawyers. But he was quite sure that he, with many others in the meeting, would take a greater interest in the subject, after hearing the paper, than they had hitherto done.

Mr. Yuill, in reply, said that when Mr. Robertson opened the debate, he had the consciousness that he occupied a different position before them that day from that which he had filled for some years past. It would be in their recollection that, in giving some contributions to the Association, there happened to be very considerable room for debate. There were some papers which lent themselves to criticism; and he was conscious that on this occasion his was more for future study, and contained points which they would require to keep before them if they desired to determine their position from a practical as well as from a financial point of view. As to Mr. M'Gilchrist, there was one point hewould like to mention, not only in reply to him, but to members generally, and that was the difference which existed between valuation and income-tax. Even the assessors admitted to him that at times they had to ask themselves whether they were dealing with one or the other, because when they ran the two together they sometimes did not know where they were. He had educated himself into the view that there was no difference between them; so that he was not surprised that some of the speakers had got these two subjects mixed up, as sometimes the assessors did themselves. When they considered two subjects of capital charges and revenue expenditure, they all knew that if they placed to revenue any capital expenditure, they lessened their profits; and if the price of gas was such as to allow this, then he certainly said that any gas manager who had the commercial interests of his undertaking at heart should charge the expenditure against revenue. But when they came to deal with the assessor, it was a different matter. In the first case, they were valuing their concern from a commercial point of view; but they were not discussing this point just then. What was before them was the assessable valuation, and not the economical or financial arrangements, of gas-works. What he said was that, in placing capital expenditure against revenue, they were doing what was right, provided they could afford it from their income. But then, after having done so, the assessor pulled them up and said: "This is capital expenditure, and I will not allow it as a deduction from income." Therefore they at once raised the assessable value of their works. He thought the members would see the point perfectly well. When they came to income-tax, it was a different thing. Any such expenditure would be treated as profit, and income-tax charged upon it. Mr. M'Gilchrist regarded the 3 per cent. deduction as inadequate. This deduction, which he had been able to get, was computed as the average for twenty years of the sum necessary to cover depreciation of meters, independently of the sum allowed in the expenditure column. That was to say, while the assessor granted them the 3 per cent. off —for income-tax purposes, not for valuation—it was over and above the sum he allowed them, under the expenditure, for repairs on meters. So that he had charged against revenue a sum for repairs on meters, but he had also allowed them the 3 per cent. further for income-tax purposes. The suspense account was another matter which also affected both income-tax and valuation; and on this point he was at one with Mr. M'Gilchrist in the desire to have such an account. But it had no place other than the mere fact of their having money behind them. In keeping a suspense account, they were practically paying a premium of 25 per cent. in taxes. He knew a case in which they took from profits more than £4000 a year for a suspense account. This was actually costing them £1000 a year in taxes. The assessor at once said: "This is a suspense account. You have taken it from profits, and therefore it is profit; and I cannot allow it as a deduction from expenditure. It must be considered in the valuation at once." Consequently, both for income-tax and for valuation purposes, their assessment was raised to the extent of £4000. Had the profits been shown without any suspense account, the valuation would have been so much less; but, having this account, it was raised £4000. Taking the assessment at 5s. in the pound, it made £1 on a year, which, as he had said, they had to pay in taxes. Instead of

creating a suspense account and dealing with it in an accountant's way, there was another way of treating it, for the prosperity of a gas-works, which some of them knew, but which he did not wish to particularize further. Mr. M'Gilchrist also mentioned the point he gave in reference to the removal of property, and asked why it should not be previously depreciated. They all knew that an assessor would not allow them a single penny of profits for depreciation on heritable subjects. What he wanted to bring out was that here was a house for which the tenant was paying so much a year, and that was the value of the house; but he could not allow the proprietor a sum off it for any repairs on the property. He could not give it to them in depreciation, but he would in income-tax. He (Mr. Yuill) thought that the Kirkcaldy case had happened at a very opportune time, because it had given him more matter to place before the members as an authority. In that case they would observe that in the income no note was given of the value of meter-hires. He thought they charged meter-hires in Kirkcaldy; but they would also note that they were not allowed any expenditure on meters, because the assessor said: "If you are not going to take as income the sum you have got as meter-rents, I am not going to allow you to deduct the sum you expend as repairs of meters." When it came to income-tax it was a different matter. If they investigated the case, they would perhaps find that if they were allowed a sum as depreciation or repairs on meters—he spoke especially of those companies or corporations who did not charge meter-rents—they required to consider whether it would pay them to have a larger sum put to their credit for tenant's capital on the value of their works, or whether they would prefer the meter repairs to stand in the expenditure columns. They had only to take the assessable value, as given by the assessor, and then make their deductions under the 37th section of the Poor Law Act. Mr. M'Lusky had referred to some of the difficulties he had experienced in Perth; and there was no doubt the large capital sum which had been spent there had had the effect of raising the sums paid on rates and taxes. What he (Mr. Yuill) wished to point out was that if they took any company with heavy capital expenditure they might naturally expect that the taxes per 1000 cubic feet of gas would also be higher. He did not wish to make a comparison, and say that this would be in a given ratio to the capital, because that all depended upon the sum charged for taxation in the individual towns. He knew that in Rothesay they must have a much smaller tax on the valuation roll than they had in (say) Coatbridge. He did not know whether any of the members, in computing valuations of works, considered the allocation of these valuations—that was to say, whether they put in a certain amount under "works" and another under "pipes." They knew that in burghs they had a deduction of 75 per cent. on the assessable value for pipes. Therefore the higher they got this figure, the less would be their assessment. This was a point which might interest them. He would mention that since his paper was sent out he had had a communication from one of their friends as to the taxes paid, to show how these affected the selling price of gas. He had given the results in his paper, showing that the highest was Perth; but if it was any hint to them, his friend mentioned that his taxes amounted to 6½d. per 1000 cubic feet of the gas consumed. They would at once see how this question affected the price of gas. He might say there was something wrong there. If the taxes were too high in that place, there was no remedy; but if the valuation was too high, it could easily be put right, if it were taken on the lines he had indicated. He thanked the members for the way in which they had received his paper.

The Benevolent Fund of the Institution of Gas Engineers.

A special general meeting of the contributors to the Benevolent Fund of the Institution of Gas Engineers was held last Wednesday, at the Offices of the Institution, No. 39, Victoria Street. The meeting, which was of a purely formal character, was for the purpose of submitting for confirmation, in accordance with Rule 35, the alteration to Rule 3 which was passed at the annual meeting of the donors and subscribers on May 31. The amendment referred to is as follows: "The fund shall be supported by means of donations, bequests, and annual subscriptions of not less than 5s." In the unavoidable absence of the President of the Institution, Mr. Charles Wood, of Bradford (who telegraphed that his train had been delayed), the chair was taken by the Honorary Secretary, Mr. J. W. Helps, of Croydon. Moving the necessary resolution, Mr. Helps explained to the small number of contributors present that the meeting was obliged to be called in order to make law what was agreed to last May. Mr. Thomas Berridge, of Leamington, seconded the motion, and it was carried without discussion.

The Irish Association of Gas Managers will, it is intimated by the Hon. Secretary (Mr. J. Whimster), hold their annual meeting in Dundalk on Tuesday and Wednesday, Aug. 15 and 16.

Mr. John William O'Neill, the Managing-Director of the Gas Purification and Chemical Company, Limited, whose name has for very many years been a familiar one throughout the gas profession, died on the 17th inst. at Woodberry Down, N., and was buried in Highgate Cemetery last Friday.

OXIDE FOR GAS PURIFIERS MADE FROM IRON SLUDGE FROM WATER PURIFICATION.

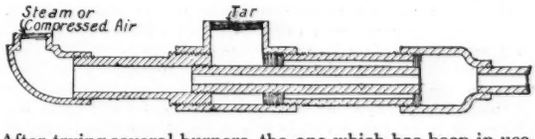
Herr von Feilitzsch, of Brunswick, has recently given in the "Journal für Gasbeleuchtung" the results of trials of the iron sludge, which is produced in the treatment of ferruginous waters, as a substitute for bog oxide in gas purifiers. The proportion of iron in many natural waters is too great to admit of their general use, and when this is the case, and no other source of water supply is available, the water is aërated until the iron present has been thrown down as oxide. The deposited oxide is of the nature of sludge, and there are usually local regulations which preclude its discharge into water courses. It will not sell as ochre, and its disposal is frequently a troublesome matter.

The iron-removing plant at Brunswick comprises aërators, coke-percolators and coarse filters, with granules ⅛ inch to 2 inches in size, which retain the flocculent iron oxide. The percolators and filters are cleansed by flushing, and the flushing water runs into an open concrete tank, 3230 square feet in area, in which the sludge settles down completely in about twelve hours. The sludge dries in about eight days sufficiently to admit of its removal to the gas-works. If exposed there under cover to the air, and rolled, it becomes a fine powder consisting of 14·40 per cent. of moisture, 10·41 chemically combined water, 48·25 ferric oxide, 3·03 manganic oxide, 12·79 silicic acid, 5·89 calcium carbonate, and small quantities of gypsum and other sulphates. The surprisingly high proportion of silica is only to a small extent sand; the bulk being finely divided hydrated silicic acid arising from the softening of the water which incidentally results from the process for removing the iron from it. The sludge was put into the purifiers in two layers, each nearly 18 inches deep, and only threw one-tenth or so more pressure than loose bog oxide in similar layers. After being fouled in the purifier six times, the sludge oxide had the following composition: Moisture 11·23 per cent., sulphur 31·17, prussian blue 10·12, soluble ammonia, 0·14, total ammonia 1·03, and sulphocyanide, stated as ammonium thiocyanate, 1·98 per cent. The percentage of sulphur in the dried material was 35·11; and as good oxide should take up over 40·0 per cent. of sulphur, the material was fouled again. The high proportion of sulphocyanide was due to the very vigorous revivification of the material at first, which caused it to ignite if not immediately damped and shovelled about.

About 60 tons of this air-dried iron sludge result from the treatment of 770 million gallons of water per annum, and its use for gas purification would result in a net saving of about £50.

USE OF TAR FOR HEATING RETORTS.

This subject was dealt with in a paper prepared by Mr. F. C. Sherman, of New Haven (Conn.), for the last meeting of the Western Gas Association. In his introductory remarks, he said he was convinced that in many instances too little attention had been given by gas engineers to the utilization of tar in the retort furnaces and the steam-generating plant; and he thought this had been brought about by discouragement resulting from short and unsatisfactory trials. They had had to contend with the smoke nuisance, variable heats, destructive cutting flame on the settings, and obstinate stokers, who object to any change in the method of firing, even when it reduces their labours. With all the information available on the subject of tar, this material was being offered at prices far below its value as a fuel. The author went on to say that he had had 25 years' experience in the successful use of tar as fuel at New Haven; and he willingly placed it at the disposal of any gas managers thinking of making an experiment. He then furnished the following particulars.



After trying several burners, the one which has been in use for the past ten years was first seen at the works of the Newark (N.J.) Gas Company. It is shown in the accompanying illustration, and is stated to be very efficient; giving very little trouble in the way of clogging, and costing only a moderate sum. Moreover, it can be made by any gas-fitter. The tar-tank feeding the burner at New Haven is 4 ft. by 9 ft., and is placed at a height of 20 feet alongside the retort-house; the tar running to the furnace by gravity. In winter the tar in the tank is heated by a steam-coil. It is desirable to have a large tank, in order to obtain uniform pressure at the burner. Compressed air or steam can be used with the appliance; but at New Haven the best results were obtained with a steam-jet. To overcome the variations in the steam pressure, a regulator is used, which keeps it uniform at 50 lbs. on the burner. The tar is pumped to the tank through a screen, which removes the dirt and lumps. The tar-valve is open full, and the quantity admitted to the furnace is

regulated by a steam-jet. If more tar is required, the steam pressure is reduced; if too much is being admitted, the pressure is increased. There is very little smoke if the pressure is kept uniform and the valves are adjusted when smoke appears. It is here that the ordinary stoker has to be kept up to his duty; for unless this is done, the retort-house will be filled with smoke. This incomplete combustion will close the flues of the settings and occasion serious annoyance and loss. Mr. Sherman has had to let down benches to remove the solid carbon in the flues. He has benches of six retorts, with half-depth furnaces, and works with four-hour charges. He uses one-third of the coke produced, or 65 bushels in 25 hours; and he finds that 150 gallons of tar will do the same work in the furnaces. He gets 10 c. a bushel for his coke, which would make his tar worth $2·16 per barrel of 50 gallons. He produces all his steam with water-gas tar, for which there is no demand in the State. Besides making all the steam with this tar, he uses it under the retorts, with the same burner employed for coal tar, and with equally good results. He uses in his steam plant a different burner from that employed under the retort-benches. On the outlet of the retort-furnace burner he puts an atomizer, such as is used in the oil distributors in the Lowe water-gas apparatus. This sprays the tar and steam in the boiler furnaces. At New Haven they take the water-gas tar from a separator, and pump it into the receiving holder tank, getting in this way oil-gas tar free from water. They have found very little difference in the life of the retorts and settings since they substituted liquid for solid fuel. They find that, for generating steam, three barrels of water-gas tar are equal to a ton of bituminous coal.

At the close of the paper, Mr. Baehr submitted a few notes he had made in St. Louis to determine the value of coal-gas and water-gas tar. He first pointed out that the results obtained from the burning of tar naturally depend very largely on the percentage of water in it; any considerable proportion reducing the calorific value of the material. Consequently, the method of burning the tar, the apparatus for doing so, the size of the combustion chamber, &c., had, he said, very great influence on the result. St. Louis had cheap fuel coal; the cost of one kind (the Zeigler Mine coal) being $2·07 per ton delivered on the works. The calorific value determined in the laboratory was 11,207 B.T.U. per pound. At the time of making the test, the boiler thermal efficiency was only 66 per cent. The equivalent evaporation from and at 212° Fahr. of 1 lb. of coal was 7·8 lbs. of water. After determining the evaporative value of the Zeigler coal, they took some Pintsch gas tar, containing 4·5 per cent. of water, the calorific value of which was 12,104 B.T.U. per pound. This was a low value of tar, and the large percentage of water undoubtedly accounted for it. The weight of this tar per gallon was 10·83 lbs. The boiler thermal efficiency at the time of the test was only 43 per cent., which showed that the combustion chamber was not properly adapted to get the best results. The equivalent evaporation per pound of tar was only 5·33 lbs. of water. The commercial value compared with Zeigler coal was only 0·79 c. per gallon. Subsequently a test was made with water-gas tar. The proportion of water in the tar at the time of the test was 0·2 per cent. The calorific value of the tar was 16,495 B.T.U.; the boiler thermal efficiency, 59 per cent.; and the equivalent evaporation per pound of tar, 9·96 lbs. of water. The commercial value compared to Zeigler coal per gallon of tar was 1·27 c. Mr. Baehr thought there was no question that the value of tar would be considerably above the figures arrived at in these tests, if the apparatus was of the most improved kind and there was a higher boiler thermal efficiency.

In the course of some remarks upon the paper, Mr. Waring said he had been able to obtain an evaporation efficiency of 13·88 lbs. of water per pound of water-gas tar free from water. Mr. Fitzgerald asked Mr. Waring how he regulated his air—how much he put under the furnace; also whether he kept the doors open or closed when making the test. Mr. Waring said he used a tar-burning appliance which he thought was devised by Mr. Prichard, of Lynn (Mass.), who did not advocate admitting any air into the ashpit. He (Mr. Waring), however, did admit some. He had stationary grates, and merely put clinkers over the bars and closed the ash doors tight. The spray was a steam-pipe under the tar-pipe, which merely atomized the tar, and air was drawn in through an opening in the fire-door. The reason for using this device was because he could change from tar to coal in a very short time. With regard to the admission of air, he explained that they had a serious explosion, burning the fireman and engineer who happened to be in front of the door, by gas generating in the ashpit. After this they merely cracked the door to admit enough air to carry away the gas. They obtained splendid efficiences by burning tar, which merely gravitated from an overhead tank.

Gaslight and Coke Company's Dividend.

We are informed by the Secretary of the Gaslight and Coke Company (Mr. H. Rayner) that the accounts for the past half year show that—subject to audit—the balance to the credit of the net revenue account will enable the Directors to recommend the payment of a dividend at the rate of £4 8s. per cent. per annum, carrying forward a balance to the next account of £217,408 4s. 6d. This result compares with a dividend at the same rate for the June half of last year, and with a balance then carried forward of £273,975 19s. 9d.

STEEL AND CONCRETE CONSTRUCTION AT THE ANTWERP WATER-WORKS.

By Easton Devonshire, Assoc.M.Inst.C.E.

[Extracts from the last Paper read at the Annual Meeting of the British Association of Water-Works Engineers.]

In this paper the author describes the construction of a covered reservoir recently completed by the Antwerp Water-Works Company at their new pumping-station at Luythagen. The materials employed in its construction are: (*a*) Rolled-steel joists, channel and angle irons forming the steel framework; (*b*) concrete surrounding this framework; (*c*) expanded metal serving as the armouring of the concrete.

The steel joists are of **I** section throughout, and are of four dimensions. The horizontal floor-joists are of the Belgian standard section, 220 mm. by 98 mm. (corresponding to 9 in. by 4 in. English section); the joists forming the wall stanchions measure 140 mm. by 66 mm. (5½ in. by 2⅝ in.); the column stanchions are 120 mm. by 58 mm. (5 in. by 2¼ in.); and the roof joists over the end bays of the reservoir 240 mm. by 106 mm. (9½ in. by 4¼ in.). The channel-irons forming the arched ribs of the roof are 100 mm. wide by 40 mm. deep (4 in. by 1½ in.), and the angle-iron forming the ties at the foot of the column stanchions are of 1½ in. by 1½ in. section.

The concrete is composed of Belgian Portland cement of the best quality, washed river sand, and pebbles screened so as to pass through a ¾-inch ring. The cement, after being air-slaked and tested, was mixed with twice its volume of sand to form the mortar. The aggregate was gauged, and cement mortar added in sufficient quantity to fill the void, with a margin of 10 per cent. Mixing was done by hand in small quantities; a minimum of water being added, and the concrete spread in thin layers and carefully tamped.

The expanded metal was used in wide sheets of the various lengths required to span the joists of the framework with a good overlap. The principal sizes used were No. 10 (mesh 3 inches, strands ¼ in. by $\frac{9}{16}$ in.), weighing 11 lbs. per square yard, and No. 15 (mesh 3 inches, strands ⅛ in. by ⅛ in.), weighing 4 lbs. per square yard. Expanded metal lathing was also used for covering the roof channel-irons.

The reservoir measures 62·43 metres in length by 40·65 metres in breadth (253 ft. 4 in. by 133 ft. 8 in.). Its depth from floor to roof is 3·16 metres (10 ft. 6 in.), the depth of water to the top of the overflow-pipes being 3 metres (10 feet). The reservoir is built entirely underground, the outside of its flat roof being at the natural ground-level.

The soil at Luythagen is compact greenish sand, water-logged under ordinary conditions to within about 5 feet of the surface. The foundation was commenced by spreading a layer of broken bricks to 1 foot deep over the whole surface; the specification stipulating that any soft places or holes should be cleared out and made good with rough concrete. Porous drain-pipes, 3 inches in diameter, were laid at intervals from north to south within this layer of broken bricks; these pipes delivering into a 6-inch drain running under the centre of the reservoir from end to end, the larger drain being extended southwards to a well sunk between the reservoir and the engine-house. Brickdust and small pieces were rolled into the surface of the draining course; and the whole was then floated in a thin layer of cement. The foundation being thus prepared, and its surface floated in cement, the whole area of the reservoir was covered with No. 15 expanded metal. The metal was laid in sheets 8 ft. long by 8 ft. wide; the long diagonals of the meshes being placed at right angles to the principal axis of the reservoir. The sheets overlap each other on all four sides; the lap being 3 inches in each direction. The outside sheets are of sufficient size to extend 8 inches beyond the outside of the reservoir walls. The sheets are so placed that their lines of overlap endwise are under the floor joists carrying the columns supporting the roof. These joists, which are of **I** section, 220 mm. by 98 mm. (approximately 9 in. by 4 in.), weighing 21 lbs. per foot run, are laid end to end in lengths of 10 ft. 5 in. They are united at their butting ends by fishplates bolted to them. The floor-joists run from east to west in parallel lines, 2·30 metres (7 ft. 6 in.) apart from centre to centre; the two outer lines of girders being, however, only 1·95 metres (6 ft. 6 in.) from the side walls. The joists being laid, wires of round iron $\frac{3}{16}$ in. in diameter were hooked through the underlying sheets of expanded metal and turned up at each side of the joists at distances apart of 10 inches.

The first layer of concrete was then laid between the rows of joists; the concrete being rammed through the meshes of the expanded metal and spread in successive layers to within 3 inches of the top level of the joists. The concrete was then completed to a level of 2½ inches above the joists; a second layer of expanded metal sheets being placed in position over the joists as the concreting proceeded, attached by the wires previously passed round the joists. The 5 in. by 2¼ in. **I** joists forming the column stanchions were placed at their proper centres on the floor girders as the construction of the floor advanced. These stanchions stand vertically on the top flanges of the floor-joists; the expanded metal being cut to pass round them. They are not attached to the joists, but are held in position at the foot by angle-iron ties running from side to side of the reservoir immediately over the

upper layer of expanded metal, with bolts passed through them on each side of the stanchion—the angle-irons being finally buried in the concrete of the floor. At the two ends of the reservoir, the floor-joists extend to the outside of the wall, and the wall stanchions which stand on them are here attached by plates bolted to the web of the joist, and bent to pass round the upper flange of the joist, and allow of bolting to the web of the stanchion. Except where the floor joists extend at the ends of the reservoir, there are no horizontal joists under the walls. Along the end walls stanchions are placed half-way between those bolted to the floor-joists; the intermediate stanchions standing on plates laid in the bottom of the floor concrete. The stanchions forming the framing of the side walls stand on similar plates at distances of 1·56 metres (5 ft. 2 in.) apart. The wall stanchions are placed centrally across the walls, except at the four corners of the reservoir, where they are at the outside angles.

The expanded metal armouring of the walls is formed of sheets of No. 15 metal placed in three rows each side of the stanchions; the long diagonal of the meshes being horizontal. On the outside of the wall the expanded metal sheets are carried down to rest upon the sheets laid on the under side of the floor, and extending beyond the foot of the wall. On the inside face of the wall, the sheets are bent to a curve at the floor-line, and are attached to the upper sheets of the floor, in order to make a continuous armouring along the angle between the walls and floor. At the four corners of the reservoir, covering sheets of metal unite the vertical armouring of the adjacent walls both inside and outside. Along the side walls, the expanded metal sheets are lapped at each stanchion, to which they are attached by $\frac{3}{16}$ inch steel wires passing round the stanchions and through the meshes of the sheets. Along the end walls, where the stanchions are closer together, the sheets of expanded metal span three stanchions, the ends being overlapped at alternate stanchions only.

For concreting the walls, a rigid centering of planks was erected outside the expanded metal on each face of the wall; one tier of expanded metal sheets being fixed at a time, so as to facilitate the spreading and tamping of the concrete—the centering planks being held in position, 8 inches apart, by chocks bearing against the stanchions and strutted on the outside.

The column stanchions, 323 in number, were all erected before the concreting of the columns was commenced, and were held in position at the top in one direction by the channel-irons of the arched ribs of the roof, and by temporary wood struts in the other direction. Straps of wire were fastened round the column joists at intervals of 10 inches; and box centering was erected into which the concrete was rammed, so as to form a square column with sides 0·18 metre (7¼ inches) wide. The columns stand at 3·12 metres (10 ft. 5 in.) centres along the axis of the floor-joists and the Golding arches above them, and at 2·30 metres (7 ft. 6 in.) centres across the reservoir.

The roof is a continuous flat slab of concrete 0·14 metre (5½ inches) thick, with an armouring of No. 10 expanded metal at its lower face, carried on Golding arches spanning the columns from east to west. The Golding arch, which is formed of a channel-iron 100 mm. (4 inches) wide, weighing 10·8 kilogrammes per metre run (7½ lbs. per foot run) filled in with concrete to the level of the slab roof, constitutes a rib which is an integral part of the flat roof; the concreting of the covering slabs and of the ribs being executed at the same time. The channel-irons, which have a rise of 11 inches, spring from angle-iron brackets riveted to the **I** joists within the columns; the top of the joists and the flanges of the channel-irons at their highest point being at the level of the under side of the roof concrete. The centering of the flat roof and of the Golding arches formed one structure. The steel channels were first wrapped in lathing, bent to the curve of the arch and hooked over the flanges of the channels, which were then enclosed between planks placed on edge, and supported on struts placed each side of the columns; the flat roof centering being formed of long planks placed parallel to the arch-centering planks, and supported on cross battens fixed to them. The sheets of No. 10 expanded metal were laid on this centering; the long diagonals of the meshes being at right angles to the line of Golding arches, over the centre of which the sheets were lapped. The concrete was then rammed through the meshes, filling up the spaces above the channel-irons; the whole floor being made up to its full height in a continuous operation.

To ensure the stability of the roof in the direction of the thrust of the arches, the end bays of the reservoir are roofed over with heavy concrete work carried on 240 mm. by 106 mm. **I** joists (9½ in. by 4¼ in.) attached to the column stanchions by angle brackets, and supported by the columns at one end and by the end walls at the other. This portion of the roof has an armouring of No. 15 expanded metal on both its upper and lower faces, and is 12 inches thick without the waterproof rendering. The wall ends of the 9½ in. by 4¼ in. roof joists are bolted to the top of the wall stanchions by means of plates similar to those connecting the foot of the wall stanchions to the floor-joists.

All the stanchions of the side walls and alternate stanchions of the end walls are anchored to the roof concrete by strips of 1½ inch by ⅜ inch bar iron bent round the top of the stanchion, and penetrating the concrete in a horizontal direction for a distance of 2 ft. 6 in. on each side of the stanchion.

Thus constructed, the Luythagen reservoir is in the form of a rectangular box with a fixed lid. The author proceeded to describe the culvert joining the reservoir to the pump sump, mentioned that the inlet-pipe (28 inches in diameter) enters the reservoir at its south-west corner, and then referred to the manhole frames and covers in the roof and to the four overflows.

Proceeding, the author said that the centering of the walls was removed after ten days; the roof-centering remaining somewhat longer. The work of rendering was then commenced. The rendering is in cement mortar in the proportions of 1 of cement to 1 of sharp sand, and is 1 inch thick throughout. The reservoir is rendered both inside and outside, with the exception of the underside of the roof.

At the south west corner of the reservoir, an automatic inlet-valve, of special design (Kennedy's), is bolted to the inner flange of the wall casting to which the 28-inch intake pipe is connected. This apparatus consists of three balanced valves working in gun-metal liners fixed in the main casting, and raised or lowered by the rise and fall of three copper floats actuating levers to which the valve-rods are connected. The floats are so arranged that all three valves remain fully open until the water in the reservoir rises to a height of 1·47 metres (4 ft. 9⅞ in.) above the centre of the intake-pipe. The first float then commmences to rise, and gradually closes its corresponding valve until, at the level of 1·80 metres, the first valve is entirely closed. The second valve is then gradually closed by the rising of the second float to the level of 2·13 metres; the three valves being finally closed by the rising of the third float to the level of the reservoir overflows at 2·46 metres above the intake-pipe. The lowering of the water-level causes the three valves to open slowly in the reverse order. The floats have a vertical measurement of 13 inches each, and the valves have a stroke of 4 inches. The water-pressure at the reservoir intake varies from a maximum of 280 feet to a minimum of 55 feet, the inlet-valves opening and closing steadily against this variation of pressure. The gradual throttling of the intake causes a rise of pressure at the Waelhem end of the main, and is a signal to slow down the Waelhem engines. The float rods pass through the reservoir roof to an indicator case, and are fitted with arrow points showing on a scale the position of the floats.

The total cost of the Luythagen reservoir, including the culvert, the drainage well and all accessories, except the automatic inlet-valve, was 111,900 frs., or £4476. The water capacity of the reservoir, including the culvert, is slightly over 7600 cubic metres, or 1,672,000 gallons. The cost therefore works out at the low rate of £2 15s. 9d. per 1000 gallons capacity. To facilitate a comparison with English prices, the author thinks that the following details showing the proportional cost of the various parts of the work will be interesting:—

			Per 1000 Gallons.
Excavation and making good	Francs	12,172·80 =	£0 6 1
Broken brick foundation and drain-pipes	,,	7,246·04 =	0 3 7
Steel framework	,,	14,927·20 =	0 7 5
Expanded metal	,,	24,182·30 =	0 12 0
Concrete	,,	37,937·30 =	0 19 0
Rendering	,,	7,349·90 =	0 3 8
Centering	,,	4,409·95 =	0 2 2
Cast-iron manholes, covers, and air-pipes	,,	675·00 =	0 0 4
Contingencies	,,	3,000 00 =	0 1 6
			£2 15 9

The unit cost of the principal materials employed was approximately as follows:—

Steel framework, per ton	£8 0 0
Expanded metal No. 10, per square yard	0 2 10
do. No. 15, do.	0 1 2½
Concrete, per cubic yard	0 19 0
Rendering, 1 in. thick, per square yard	0 0 9
Centering do.	0 0 5½

The author described the tests applied to the reservoir in order to ascertain whether it was water-tight; and it proved perfectly sound under all conditions. There were some minute cracks in the roof. As a critic of the method of constructing a roof of this nature, the author thinks that the concreting should be done in strips at right angles to the Golding arches, and laid in a succession of long slabs, with a joint space left between them; the joint being filled in with cement or bitumen after the shrinkage of the concrete has taken place, and before the roof is rendered.

In concluding his long but interesting paper, the author remarked that the lightness of construction rendered possible by the combined use of steel and concrete results in economy of space, which is worthy of notice. The Luythagen reservoir, measured outside the walls, occupies an area of 2590 square metres, and the 323 columns occupy a space of 16 square metres for a water area of 2522 square metres. The total space occupied by the structure adds, therefore, less than 3½ per cent. to the water area.

Summary of Discussion.

Mr. W. MATTHEWS (Southampton) pointed out that there had been a great deal of controversy as to the adoption of the method of construction described in the paper; but unfortunately up to now it had not met with a great deal of favour in some quarters—in a way he need not touch upon. He hoped the publication of papers of the sort in this country might have the effect of removing the prejudice to which he referred. The first point that struck the members would be the extraordinary lightness of the construction, which in this case was of particular value in view of the bad ground; but that was no reason why it should not be of particular value in their own practice. The total weight placed upon the foundations was exceedingly moderate. It was a very

strong reservoir, as they could judge by the tests Mr. Devonshire had told them were made. Here again was a point that commended itself to their notice—the careful manner in which experiments were made, and not adopting that rough-and-ready method which was so often applied, of filling up with water at once, in more or less careless fashion, with sometimes disastrous results. Another point that must appeal to them all was the marvellous cheapness of this reservoir. He could not call to mind any example of a reservoir approaching this low figure. Then, again, there was the short time in which the reservoir was constructed. Six months for the construction of a reservoir which approximately held about 1¼ million gallons of water seemed to him remarkable. They must in Belgium have some exceedingly good contractors, and exceedingly good plant; and the whole thing must have gone off without many hitches. He agreed with the author's remarks as to the value of the rendering of concrete reservoirs. He (Mr. Matthews) had adopted the same thing in practice; and there was no doubt that cement rendering would, if properly carried out, make a reservoir absolutely water-tight. There was no necessity for all those expensive and very doubtful methods of building up reservoirs with practically independent walls and a water-tight material between them—breaking, as it were, the walls into sections, and largely destroying the strength of the material. In cases of this sort, by putting in bituminous compositions and so on, they were simply breaking the structure up; and they must then depend very largely upon absolute weight for stability. He thought, too, that probably Mr. Devonshire was quite right when he said that, as a critic of the method of constructing a roof of the nature described, it would have been better to put the concrete in in the form of slabs, and thereby get over the contraction; afterwards running in the joints either with some plastic material or concrete. There were very few concrete structures that he had seen, with large surfaces, where cracks had not developed in them. The Kennedy valves which were referred to were very interesting, as getting over the difficulties possibly many of them experienced. He had himself had great trouble in obtaining a nice steady closing and opening of valves under varying pressures. Many of these automatic valves were very difficult to deal with. They were all right so long as they were open, or open a fair distance; but when the pressure began to accumulate upon them, then difficulty came.

Mr. Percy Griffith (London) said he would like to call attention to what he thought would strike every member as the fascinating point with regard to this paper. It was the figure as to the cost of the reservoir per 1000 gallons. This figure, as Mr. Matthews remarked, was very exceptional; being only £2 15s. 9d. per 1000 gallons. He thought there were many engineers in the room who would share with him the feeling that, if they could get reservoirs constructed at this rate, they would adopt any reasonably successful system, in order to bring the price down to the figure. It would be interesting to the members if Mr. Devonshire would advise them as to how far this very low price was governed by the method of construction, and how far by the cost of labour in Belgium as compared with the cost of labour in this country. He thought this point would make the figure of extreme value to every one of the members.

Mr. J. J. Lackland (St. Helens) said he should like to mention that, under favourable circumstances such as he had had to deal with himself, the cost of a concrete reservoir, without armoured construction, could be got down still lower. During the last twenty years, he had had experience in the construction of four concrete reservoirs, ranging from a capacity of 100,000 gallons (which was a small one) up to the latest of 10 million gallons, which, of course, was comparatively large for this class of reservoir. In the last reservoir constructed, the whole of the building material, excepting the cement, was obtained from the excavation, and was partly in rock, which was an eminently favourable position for a reservoir. The cost of the cement was 45s. per ton; and the rest of the material being got for nothing, the cost was, of course, represented by labour. In this case, the cost of the concrete per cubic yard was 15s. 9d. He noticed that, in the author's case, the concrete represented 1 cubic yard per 1000 gallons of capacity. He gathered this from the fact that the concrete was put at 19s. per 1000 gallons of capacity, and also at 19s. per cubic yard. The reservoir to which he referred at St. Helens ran up to 1·8 cubic yards per 1000 gallons of capacity; so that, if they compared the two, the cost of the steel framework, expanded metal, and concrete together (which represented the carcass of the author's reservoir) amounted to 38s. 5d. per 1000 gallons capacity, while, in the St. Helens reservoir, the cost of the carcass of concrete only, at 15s. 9d. per cubic yard, amounted to 28s. 4d. per 1000 gallons of capacity. This was 10s. per 1000 gallons of capacity in favour of the ordinary concrete construction under favourable conditions, of course. The total cost of the St. Helens reservoir, including land and two lengths of 21-inch main which were laid some distance from the reservoir, was £27,000, which gave a total cost for construction complete of £2 14s. per 1000 gallons capacity. He had found that making water-tight by cement rendering could be done without any difficulty whatever; and it gave first-class results. When finished, there was not a crack in any single part of the reservoir construction. Of course, the reservoir had not been built very rapidly. It took rather over two years in construction, which, of course, was favourable to the avoidance of cracks. He noticed that the author quoted rendering 1 inch thick at 9d. per square yard. He had never known this price to be approached in England. It would probably be, for 1 inch thick, 2s. or 2s. 6d. per square yard in parts of the country with which he was acquainted.

The President (Mr. P. H. Palmer) inquired the depth of water in the St. Helen's reservoir.

Mr. Lackland replied 16 feet; and the arches were of 15 feet span.

The President remarked that the use of armoured concrete on the Continent and in America was very general; and they could there see constructions which in this country would be considered almost silly, simply because they had no rules to guide them here as to the use of armoured concrete. In Germany especially, the study and the design of armoured concrete was getting now to a high pitch of perfection. Science was taught in the technical schools; and this particular subject was being considered and studied by their engineers generally. In this country, up to the present time, the matter seemed to have been one that was taken up almost as a hobby by some people, or regarded as a thing to be considered almost as an experiment. This might be partly due to the fact that there had been great difficulty in obtaining loans for work in armoured concrete; and so most of the work that had been carried out had been by private companies. Still in this country there were many structures worthy of a visit, in order to see what could be done by this system. Rapidity of construction, cost, and strength were all in its favour. They might depend upon it that before very long armoured concrete would enter into pretty nearly all engineering work; and it was a subject that engineers generally should take thoroughly to heart and thoroughly study. He was convinced that sooner or later the governing bodies in this country would come to their senses, and find out that armoured concrete was a thing they could lend money upon, and favour in every way.

Mr. A. B. E. Blackburn (Sunderland) said that unfortunately in his district the ground was constantly slipping through colliery workings, and in a great many such districts in England, one had to consider the type of construction which would best withstand this subsidence of the ground. He should like to have Mr. Devonshire's opinion as to whether this type of construction would in such circumstances be a suitable one. He had, in his own case, an old reservoir which during the last twelve months had gone down some 12 inches. The reservoir was leaking two years ago at the rate of nearly ½ million gallons a day. He had to repair it with bitumen sheeting, and had found this to be entirely successful. No leaking whatever had taken place since, although the reservoir had subsided 12 inches in the course of twelve months. It would be interesting to hear whether Mr. Devonshire thought that, with poor ground of this nature, the type of reservoir he had described in the paper would be a successful one. He was much struck with the cheapness of the reservoir and the quickness of construction. He (Mr. Blackburn) had carried out a 3 million gallon reservoir in the course of thirteen months, and had the water in it. This he thought was good; but Mr. Devonshire's example was better.

Mr. H. E. Stilgoe (Dover), among his points, asked for a little more enlightenment on the question of mixing concrete. He also remarked that, in the use of concrete in this particular form of construction with expanded metal, it did appear to him, where a structure was of so slight a description, it was not only necessary to have the stone small as described (¾-inch), but also to have a stone which more readily adhered to the cement and sand than would ordinary pebbles. Of course, circumstances governed cases; and probably in this case it was the only material at hand without carting it some considerable distance. It appeared to him that, for structures of this kind, something in the nature of broken stone, or else very hard furnace clinker—something of that kind—would go very considerably towards the strengthening of a structure where the walls and the roof were so slight; and, moreover, it would appear in a case of this kind that it was particularly necessary where the character of the work beneath was more of a bursting character—tension rather than compression.

Mr. H. W. B. Cotterill spoke of the jointing of successive layers of concrete. At the works where he is engaged, they had, he said, various ways of making these joints with the old-fashioned concrete. They found the best way was to chip the old surface. With regard to the reservoir described by the author, he noticed that the automatic inlet-valve and the outlet-valve were on the same side of the reservoir. If they were not so near together, he thought a better circulation of the water would be obtained.

Mr. W. Phelps thought there was some mistake as between the costs of the concrete and the rendering.

Mr. A. J. Jenkins (Jersey) commented on several points. Among them he doubted whether in bad ground, if a large amount of outside water had to be kept out, it would not be better to introduce bitumen than rendering. But he noticed in the case of a well that, if they rendered it externally, they could keep the water out as well with cement as with bitumen. The costs of the works given by the author he regarded as extremely valuable. But the members could not get at the costs of Mr. Crowther's reservoir (*ante*, p. 180) per 1000 gallons, because he had added a water-tower.

Mr. C. E. Jones (Leyton) observed that, after the eulogy that had been deservedly bestowed upon the paper and the author, he did not wish to say anything that could be misconstrued; but he did think the costs of this reservoir should not go out to water companies and other authorities in this country as a typical case. There were very few places in the country where it would be possible to erect a gossamer reservoir like this; and, in his

opinion, there would be very few engineers in the country who would—either in the Midlands or the North especially—care to put up a structure of the kind. It might be possible, he knew, to find one or two cases where such a thing would stand; but he thought himself that the margin of safety for a reservoir in this country was by no means assured in the structure before them. He wished to guard the great profession of water engineering against this class of reservoir, notwithstanding the assurance they had had that it would be the construction of the future. He did not wish these costs to be taken as a fair criterion of what a reservoir should cost in this country. The conditions were so utterly at variance. The physical, geographical, and geological difficulties in this country were all of a very varied nature; and the cost of constructing a reservoir in one part might be three or four or five times the cost of a similar one in another part of England.

Mr. DEVONSHIRE, in the course of his reply, said he was not the author of the reservoir, but he was of the paper. Mr. Griffith had spoken of the cost of the reservoir; and there was no doubt about it, the cheapness of the reservoir was governed by the cost of labour in Belgium. It certainly would be impossible, with English trade unions, to get concrete work and rendering done at anything like the prices quoted by the Belgian contractor, who carried out the work well to time. The man who was a plasterer would do no rendering in England; and their prices were twice as much as for Belgian or French work. As to the cost of the cement, he should think it probable the contractor got it at about 18s. per ton—not more for the very best. The price of cement had been exceedingly low in Belgium lately. This would explain the cheapness of the rendering, and also indicate the great amount of labour put into the concrete. The cement and other materials were cheap, but for making the concrete by hand, and putting it in in small quantities, the total costs ran up comparatively high as compared with rendering. The mixture of the concrete was a most important matter; and it was one that had interested him for the last twenty years. There was a general rule for strong concrete work in France and Belgium that, whatever the aggregate might be, the "void" in it must be measured, and sufficient cement mortar added to fill the void with a margin of 10 per cent. In this case round stone pebble was used; and so far as he could remember, the void was equal to 45 per cent. of the mass, adding one-tenth gave 50, and having 1 to 2 mixture of mortar, they had practically the proportion 1, 2, 3. They had 1 to 5 concrete: 1 of cement, 2 of sand, and 3 of aggregate. In all cases where they followed this plan, they approached uniformity and perfection and solidity of the mass. Filling the whole of the holes and interstices, they must get solidity. If they used broken granite or broken rock, provided they got it more or less of a regular size of fineness, they would certainly have a harder or more solid concrete; but this was exactly where in armoured concrete work the comparatively small importance of the tensile strength of the concrete was so fairly brought out—the steel itself making the concrete of the greatest possible strength for the purpose. In this case, they put in steel as the tensile member of the slab, and calculated the steel for the tensile strains independently of any additional strength in the concrete. Referring to what Mr. Jones said as to the margin of safety, in all the calculations there was a margin of safety of 4. In regard to the possibility of doing the work in England, it was not a question of climate at all. Armoured concrete work was subject to rules and data which were as easily followed as those for cast-iron tank work. They could build a cast-iron tank quite as easily in Lancashire as in Antwerp; and equally well they could do such work as he had described, when they understood the proper construction of a concrete reservoir or tank. Mr. Lackland gave them some interesting information as to the cost of a reservoir made in concrete without armour. He (Mr. Devonshire) was not holding a brief specially for this class of construction; and, in some cases, concrete without armour might be equally economical and sound. As regards the actual price, he was naturally bound to defend his own reservoir. Making a reservoir of 10 million gallons as compared with his own of 1¾ millions, he thought they would naturally find the former came out a good deal cheaper; seeing that they got four times the volume of water in twice the length of walls. He thought the 1s. 9d. difference between Mr. Lackland and himself would very soon be swamped if they went to even 2½ millions capacity. The depth of water was another important item. Of course, with good ground, they could make a reservoir deeper, and it was cheaper to do so. In the ground they had to deal with at Antwerp, he much preferred a shallow reservoir. As to Mr. Blackburn's question, he thought the subsidence of his reservoir must have finished before he put in the bitumen sheeting, or it must be tough sheeting if it could stand actual subsidence. If the steel framework and armoured concrete was properly made, it would stand a great deal of subsidence; being more elastic than ordinary constructions. In regard to the jointing of the concrete, there was none vertically. The sheets of expanded metal lapped at the stanchions; and the only jointing consisted in the uniting of the successive horizontal layers of the concrete by efficient tamping. Experience showed that, in the direction in which the expanded metal was rigid, there was no localized shrinkage of the concrete; and liberties might be taken in making joints, without fear of any failure resulting.

REGISTER OF PATENTS.

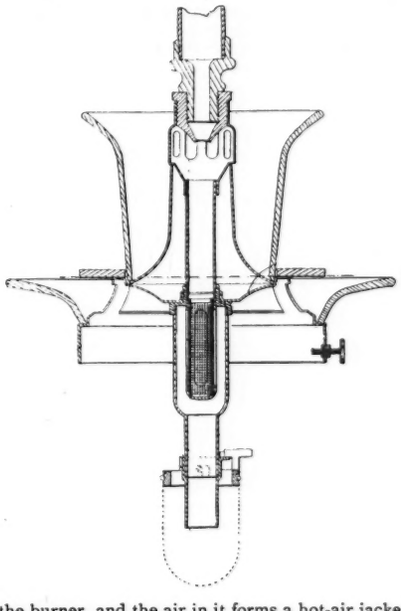
Gas-Stoves.—Nutting, J., of Balham, S.W. No. 15,698; July 14, 1904.

This invention has for its object to provide an attachment to that part of the stove where the burners for heating the cooking utensils are fitted; and it is especially applicable to stoves fitted with the tubular boiler described in patents Nos. 19,583 and 23,151 of 1901.

In all gas-stoves where a rack or bars are used to support the cooking utensils, the patentee points out that the heat from the burners, after passing through the grid or around the tubes of the boiler, is lost at the side of the utensil. But according to this invention, the part above the gas rings or burners is enclosed by side ridges or plates, and the top by a plate which extends over the whole of the burners of the stove and rests upon, or is supported from, the side plates. This plate is formed with rings and removable discs over apertures in it above the burners, so that when a kettle or saucepan is to be heated the ring or disc in the plate above the burner which is to be used is removed and the saucepan placed so as to cover the hole in the plate, and when the burner is lit the heat from it serves not only to heat the saucepan, but will be spread over the whole of the space enclosed, and may serve to heat other saucepans or vessels placed over other openings in the plate or on the plate. When used with a tubular boiler such as described in the prior patents, the boiler will have a much greater heat concentrated upon it than would be the case with an open rack. The plates are preferably formed with perforations or apertures for the escape of the gases and heat at the back of the stove, or at the sides, or where required. Preferably where a hot-water tank is employed, as described in the prior patents, these perforations or openings are fitted beneath so as to utilize the heat, or, if required, the heat may be conveyed to the boiler by a short flue disposed adjacent to it.

Inverted Incandescent Gas-Lights.—Warry, J., of Edgbaston, and Wigley, P., of Birmingham. No. 15,883; July 18, 1904.

The patentees provide an inverted bunsen burner, having a gas-inlet nozzle and air-inlet apertures at the upper part (as shown), and a downwardly projecting injector tube leading to the mixing-chamber. Surrounding the greater portion of the injector tube is an enclosed annular chamber, the lower part of which is enlarged so as to form the annular holder for the globe or shade. This chamber is heated by the waste



heat from the burner, and the air in it forms a hot-air jacket round the injector tube, so as to heat the gaseous mixture passing through it. At the lower part of the injector tube is the mixing-chamber, which the injector tube enters; and at the bottom of this chamber is a tubular outlet provided with the mantle support through which the tubular outlet from the mixing-chamber (or a continuation of it) projects for such a distance into the mantle that the flame plays properly upon the latter. The passage from the injector tube to the mixing-chamber is through long slots or other openings in the injector tube covered with wire gauze, which prevents lighting-back. Surrounding the mixing-chamber (and of considerably larger diameter) is a trumpet-shaped tubular flue (the converger) made of glass or other suitable material. The top of the converger is carried by the globe or shade holder, and the lower part of it is about level with, or a little lower than, the top of the mantle ring. It is a little larger in diameter than the mantle, so that there is an annular space between the outside of the mantle and the bottom of the converger for the purpose described later on. The bottom of the converger may be made with (or carry) a small globe or bulb which surrounds the mantle and protects it, and may also serve to diffuse the light. This small globe or bulb has an inlet at the bottom for the admission of air to support combustion. In the globe or shade holder above the converger there are openings through which the heat and products of combustion pass out to the atmosphere. Below the air inlets to the bunsen burner, and partly surrounding them, there is a tubular guard or deflector to prevent or minimize the possibility of the products of combustion arising from the mantle entering the air-inlet holes to the bunsen burner.

When the light is burning, the gaseous mixture passes down the injector tube, and through the wire gauze or perforations in the lower part, into the annular mixing-chamber surrounding it, and out through the tubular outlet at the bottom of the mixing-chamber. It burns within and around the mantle; the bulk of the products of combustion and waste heat passing up the annular space between the interior of the mantle and exterior of the tubular outlet from the mixing-chamber into the trumpet-shaped converger and out through the top outlets to the atmosphere. At the same time fresh air entering the globe through the air-inlets plays on the exterior of the mantle and supports combustion; and owing to the lower part of the converger being of a little larger diameter than the exterior of the mantle, there is, when the lamp is burning, a circular up-draught of air which, after converging onto the outside of the mantle, passes up the converger and out through the outlets at the top. This up-draught of fresh air supplies "the necessary oxygen to cause intense incandescence," and also keeps the flame properly in contact with the walls of the mantle and assists in keeping cool the converger and the globe.

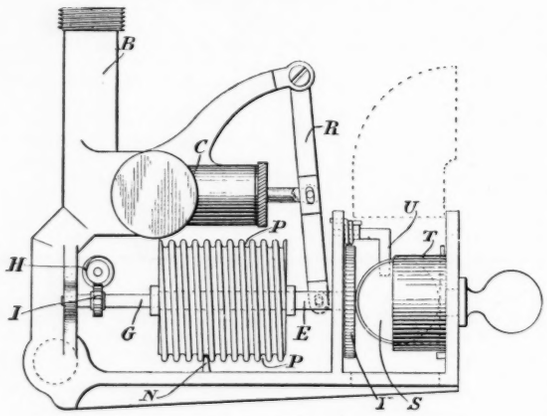
Lighting Incandescent Burners in Street-Lanterns.—Milne, J., and O'Connor, H., of Edinburgh. No. 15,884; July 18, 1904.

For igniting the burner of incandescent gas-lights in street-lanterns, the patentees propose to attach to the lantern a swivelling arm with a burner at one end, in such a way that the burner on the arm passes through the top of the side of the lantern, but when swivelled passes over the top of the burner until it is resting against another side of the lantern. The swivelled arm is preferably attached to a cock so that when the burner on the arm projects through the side of the lantern the gas-passage through the cock is full open, and the gas at the burner can be ignited outside the lantern by the ordinary torch. The arm is then swivelled over the incandescent burner and ignites the latter, and is further swivelled over to the other side of the lantern when the cock is closed and the light on the arm is turned out.

[An illustrated account of the invention appeared in the "JOURNAL" for March 7, p. 642]

Coin-Freed Meters.—Beaumont, F. J., of Stroud Green, N. No. 18,520; Aug. 26, 1904.

The object of this invention is, firstly, to provide an appliance for effecting the opening and closing of the meter valve; secondly, a coin-operating and price-changer mechanism in which the meter valve mechanism or the clockwork gear cannot be operated by the action of the coin until the coin has fallen from its pocket wheel—it being therefore impossible for anyone to start the meter mechanism by jerky or irregular movements so as to cause flickering or jumping of the lights when turning the supply knob or handle.



The illustration shows a side view of part of a gas-meter with the coin-freed mechanism attached to it, a section of the hollow worm showing its two internal longitudinal slots or guides for its end-on travel, and a sectional plan of the hollow worm and nest of mitre wheels which operate the opening and closing of the gas-valve through the medium of a sliding frame actuating a lever connected with the valve spindle.

B is the gas-inlet and C the gas-valve. There is a mitre wheel D mounted on the coin-operated spindle E, for turning on the supply; the wheel being in gear with a nest of other mitre wheels F F^1, one of which (F^1) is mounted upon another spindle G, which is operated by the meter mechanism by a worm H and pinion I for shutting off the supply. The two idle or side mitre wheels F revolve on axles J fixed to a central block or box K in which the ends of the spindles G E have a bearing. The nest of mitre wheels is enclosed within a hollow worm or screw L, mounted loosely to slide upon the two spindles G E at each side of the mitre wheels; and within the hollow worm L are two grooves or longitudinal guide-slots M, which allow the hollow worm to slide longitudinally on the ends of the axles J projecting from the idle mitre wheels F. A fixed projection or stop N is arranged in the meter casing in such a manner as to engage in the external thread P of the hollow worm L.

The effect of this arrangement is that when one of the spindles E or G is turned, its mitre wheel will revolve the two idle mitre wheels F, which will ride over the mitre wheel D or F^1 of the other spindle not being operated, and cause the hollow screw L to rotate through the medium of the projecting axles J engaging in the two internal grooves M of the screw. This rotation of the screw L is converted into an end-on movement by the fixed projection or stop N engaging in the thread P of the hollow screw L, thereby forcing the screw sideways as it rotates in either direction. This end-on or sideways movement is communicated to a frame Q and lever R, a rod or other suitable arrangement for operating the gas or other supply valve C.

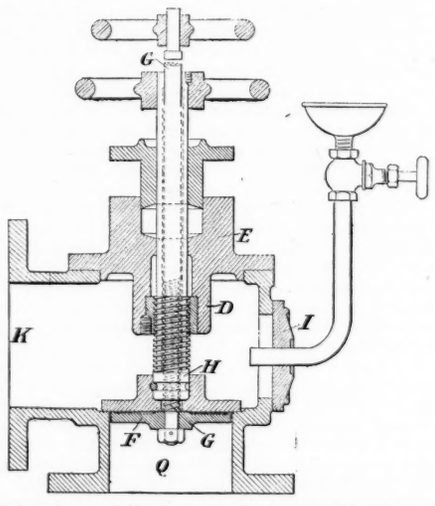
According to the improvement referring to the coin-operating mechanism, the coin S, while in the pocket wheel T (or when falling from it), acts on the arm U of a pivoted lever V when the pocket wheel is turned so as to raise the other end. The lever V is provided with a pawl W, which engages, on the return of the lever by the spring X, with the teeth of a ratchet-wheel Y connected with the meter-operating spindle E. The amount of rotation of the ratchet-wheel, and consequently the amount of supply, is governed by an adjustable stop Z, duly graduated so as to limit the return travel of the lever V in accordance with the amount of supply required to be furnished in return for the coin inserted.

The turning of the coin-pocket wheel T, it will be noted, has no direct effect on the meter-operating mechanism proper, as the latter is not actuated until the lever V is returned by its spring X after the coin has left the pocket-wheel.

Stop Valves for Gas-Mains of Coke-Ovens or other Gas-Producing Plant.—Burt, Boulton, and Haywood, Limited; a communication from Alfred George Byard, of Vizcaya, Spain. No. 8539; April 20, 1905.

This invention relates to apparatus to be substituted for the hydraulic seal usually interposed between the gas-outlet of coke-ovens or other gas-producing plant and the gas-main. It consists essentially in the combination of a stop-off valve whereby the gas-main may be cut off from the oven or producer and means for removing the fouling which accumulates in the connecting passage and valve seat.

The valve (of the ordinary screw-down type) has a hollow spindle, screw-threaded externally at its lower end and engaging with a nut secured in a boss D of the stuffing box E, which projects inside the valve casing. Below the valve is a disc F, secured to the end of a



spindle G passing axially through the valve and valve-spindle and externally screw-threaded for part of its length to engage with a nut secured to the valve or its spindle. The valve-spindle and the disc-spindle are fitted with hand wheels, by means of which they may be moved relatively or together.

Passing through the valve casing, or through a cover I, which is removably secured in any suitable manner over an opening in the wall of the casing opposite the gas-main K, is a syphon-pipe, which extends upwards to a reservoir or cup provided with a tap by means of which a small quantity of fluid tar oil may be admitted when required to the valve and valve seat, so as to dissolve any tarry deposits thereon, and thereby ensuring a gas-tight joint when the valve is screwed home on its seat.

When the valve is open, both it and the disc F are raised by the wheels to their upper limit, thereby placing the gas-main connected with the pipe P in communication with the gas-producing plant through the short connecting pipe Q.

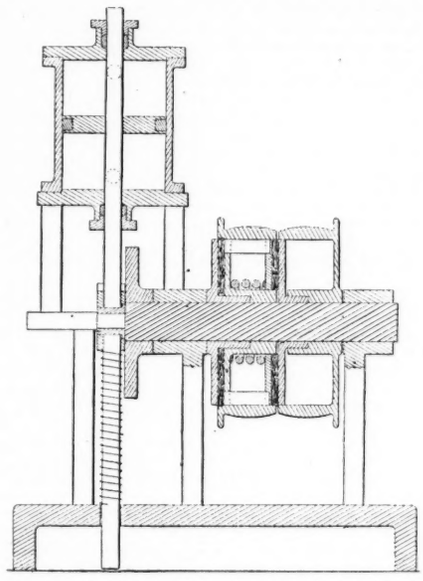
The clearing of the pipe Q from fouling may be effected simultaneously with the closing of the valve by first screwing down the disc F until it is approximately level with the top of the pipe, after which both the disc and the valve may be lowered together by the hand wheel until the valve is closed on its seating—the fouling removed by the clearing disc returning to the furnace.

Increasing and Equalizing the Pressure of Gas.—Cook, E. S., of South Lambeth Road, S.W., and Chipperfield, W. H., of Myddelton Square, Clerkenwell, E.C.. No. 8543; April 20, 1905.

This invention has for its object "the increasing and equalizing the pressure of gas, with a view to obtaining greater efficiency of light and

heat, and also to enable a larger unit of light to be used than is at present possible with the pressure ordinarily supplied by gas-mains."

The patentees construct a cylinder with a reciprocating piston, having inlet and outlet valves, sufficiently sensitive to permit the flow of gas (at ordinary pressure) from the main to each side of the piston, through the cylinder and out by the opposite outlet valve. Immediately the piston is operated, the inlet and outlet valves permit the passage of gas, but in one direction only. The piston is connected to a crank, on the shaft of which is a driving wheel, running freely, adjacent to a friction face, or between two friction faces, composed of leather or other suitable material. The wheel is made in two parts (either or both performing the function of an expansible side), and contains a spring, situate



between the two parts of the wheel and giving a definite and regular pressure against the friction face, or faces. The driving wheel is rotated by a band, and the friction exerted on the faces which are fast on the driving shaft imparts to the shaft motion sufficient to compress the gas in the cylinder to the required extent. When this pressure is reached, the wheel continues revolving, but does not carry the shaft with it, until a portion of the body of gas already compressed in the cylinder is being used, when the piston is caused to follow the lessened body of gas and thereby maintain the pressure by the requisite motion being imparted to the piston through the medium of the friction faces. The driving wheel is rotated at considerably higher speed than the normal speed of the piston; so that, at the dead-centres, where the pressure in the cylinder is variable, the friction exerted overcomes the lessened resistance on the piston at a greater speed than the normal speed of the piston until it approaches the maximum velocity of wheel—thereby equalizing, or nearly equalizing, the pressure in the cylinder.

The illustration shows a sectional elevation of the apparatus, and the driving wheel and friction faces.

APPLICATIONS FOR LETTERS PATENT.

11,971A (1904).—Clay, J., "Production of combustible fluids for power purposes." July 13.
14,157.—Richardson, S. T., and Price, R., "Preventing the fraudulent use of coin-freed gas-meters." July 10.
14,181.—Topley, S., "Gas-brackets." July 10.
14,264.—Griffin, S., "Suction-gas apparatus." July 11.
14,273.—Gray, H., "Lighting billiard saloons." July 11.
14,334.—Illy, A., "Gas-generators." July 11.
14,357.—Keeling, S. H., and Picken, H. M., "Incandescent burners." July 12.
14,368.—Barnes, J., "Anti-vibrators." July 12.
14,369.—Townsend, H., "Dip-pipes." July 12.
14,389.—Renshaw, W. J., "Gas power." July 12.
14,405.—Gasmotoren-Fabrik Deutz, "Production of motor fluid for gas-turbines from bituminous coal." July 12.
14,408.—Scrafford, D. E., "Meters." July 12.
14,456.—Hutchinson, C. H. & B. G., "Coin-freed meters." July 13.
14,486.—Gasmotoren-Fabrik Deutz, "Gas-turbines." July 13.
14,498.—Fielding, J., "Gas-producers." July 14.
14,538.—Hawkins, T. H., "Generating acetylene." July 14.
14,575.—Foster, H., and Greener, O. T., "Gas-producers." July 14.
14,590.—Lea, J. W., and Perrins, J. H., "Mantle holders." July 15.
14,633.—Zechnall, L., "Gas-burners." July 15.
14,641.—Greenwood, A., and Andersson, K., "Gas-turbines." July 15.

Failure of an Ex-Gas Secretary.—At the Pontypridd Bankruptcy Court last Tuesday, Mr. S. Wilson Phillips attended for public examination. Up to a few years ago, the debtor was Secretary to the Dowlais Gas Company; but subsequently he started business as an Accountant. Not meeting with any success in this direction, he started as a stationer and tobacconist at Senghenydd; but this only increased his losses. The liabilities were very small—under £200.

CORRESPONDENCE.

[*We are not responsible for opinions expressed by Correspondents.*]

The Judgment in the Cannon Brewery Case.

Sir,—My attention has been called to a review of my handbook on the subject of "Gas, Water, and Electric Lighting," which appears in the current issue of the "Journal." I do not, as a rule, take any notice of reviewers' criticisms; but in this case I make an exception. The principle of law which may be gathered from the House of Lords case of *Cannon Brewery Company v. Gaslight and Coke Company*, and to which your reviewer calls attention, is that stated in the handbook. Such statement is an accurate, and not a "bald," statement of the law, as suggested by your reviewer. See *Gaslight and Coke Company v. Mead* (45 L.J., M.C., 71), cited with approval in the above-named House of Lords case.

Middle Temple, E.C., July 21, 1905. Laurence Duckworth.

The Affairs of the Continental Union Gas Company.

Sir,—As an old shareholder in the Continental Union Gas Company, I was pleased to read that, in your opinion, "it is to be hoped that some at least of the members of the Board will recognize the advisability of retirement," and that the Board "requires to be thoroughly reconstructed."

Shareholders, like myself, who paid more than double the present price of the stock, did so under the impression that the dividends of 13 per cent. then paid, were only paid after the most adequate sums had been set aside to fully redeem the capital on the termination of the concessions. Now we find that, instead of such having been the case—as in the older Companies, like the Imperial Continental Gas Association and the European Gas Company—and which have largely contributed to the stability of these Companies, in the Continental Union Gas Company only a very small redemption fund has been created. Indeed, it appears to me that the latter Company has been worked more on the lines of a gold mining company, which usually pays away in dividend all its profits, leaving each shareholder to create his own redemption fund. I should not have objected to this, if I and all the other shareholders had been informed that such was the case. I should then have paid for the Continental Union gas stock, with its 13 per cent. dividends, about 130 per cent., instead of 240 per cent., and should have been satisfied with the present state of affairs.

I see in the new Articles of Association, that article 76 does not limit the directorate to holders of ordinary stock, but evidently admits a holder of £2000 of preference stock to become a Director, and share as a Director of the Company and La Compagnie L'Union des Gaz in the extravagant allowance of £6000 per annum—a sum quite large enough to obtain the services of the most capable of gentlemen, both commercial as well as scientific.

July 22, 1905. Interested.

"Enquirer" writes: "Can anyone inform me how to get rid of ammoniacal liquor at a Colonial gas-works, where there is no demand for sulphate of ammonia, and where it is not allowed to be run into the sewers."

PARLIAMENTARY INTELLIGENCE.

HOUSE OF LORDS.

The following further progress has been made with Bills:—

Bills reported, with amendments: Rhondda Urban District Council Bill, South Barracas (Buenos Ayres) Gas Bill.

Bills read the third time and passed: Bootle Corporation Bill, Esk Valley Power-Gas Order Confirmation Bill, Inverness Gas and Water Provisional Order Bill, London Gas Bill, South-Barracas (Buenos Ayres) Gas Bill.

HOUSE OF COMMONS.

The following further progress has been made with Bills:—

Bill read a second time and committed: Rhymney and Aber Valleys Gas and Water Bill.

Lords Bills reported: Blackpool Improvement Bill, Gas and Water Orders Confirmation (No. 2) Bill (relating to Tavistock and Ystalyfera Gas, and Dorking, Maidenhead, and Wey Valley Water).

Lords Bill read the third time and passed: Gas and Water Orders Confirmation (No. 2) Bill.

Sales of Shares.—A few days ago, Messrs. J. Cumberland and Sons sold by auction 81 fully-paid £10 shares in the Dunstable Gas and Water Company at £17 7s. 6d. and £17 10s. each. Last Friday, Mr. John Hunter sold £11,788 of 5 per cent. maximum stock of the Hartlepool Gas and Water Company in £100 lots, which fetched from £123 5s. to £124 15s. each. The stock was put into the market to wind up an estate.

LEGAL INTELLIGENCE.

HIGH COURT OF JUSTICE—KING'S BENCH DIVISION.

Tuesday, July 11.

(*Before the* LORD CHIEF JUSTICE *and a Special Jury.*)

East Ham Corporation v. Ilford Gas Company.

On the hearing of the case being resumed to-day, evidence was given on defendants' behalf that the flood was caused by the unprecedented rainfall in June, 1903.

Mr. *E. K. Burstal* said he had known the watershed of the Roding for many years. The river from its source almost exclusively flowed through clay ground, with tippings of granite, so that there was hardly any absorption such as occurred in the Lea Valley, where the subsoil was chiefly chalk. The rainfall in June, 1903, was unprecedented—nearly 4 inches falling on the 13th, 14th, and 15th; and this following four or five wet days, when 1¾ inches fell. The 1¾ inches would more than saturate the ground, so that over 2 inches had to be discharged in 24 hours. A fall of 1 inch of rain would give 3760 cubic feet per second in the Roding at the bridge. The quantity that the bridge was capable of taking was 2030 cubic feet per second; and the Aldersbrook bridge would take about 500 cubic feet. The flooding of the Roding on June 15 and 16 could not have been discharged without flooding the marsh land.

This concluded the evidence.

Mr. DUKE (who appeared for the defendants) suggested that the following questions should be left to the Jury: Were the defendants negligent in the execution of the works (*a*) in cutting and reinstating the bank, (*b*) in closing the Aldersbrook, and did that negligence in either or both cases produce a flood? Was the open area in the Aldersbrook after the defendants had closed it (*a*) a source of danger to lands below? (*b*) Did defendants know, or ought they to have known, that it was a source of danger? (*c*) Was the existence of this open area the cause of the flood? Would the flood, as it occurred, have happened from natural causes, and could it have been prevented by reasonable foresight and care on defendants' part?

Mr. LUSH, K.C., for the plaintiffs, said he should not object to these questions, with some slight variations, being left to the Jury.

Mr. DUKE then summed up the evidence, submitting that it had been clearly proved that the arches of the Roding bridge were obstructed to a very material extent, and that nothing which defendants had done to the Aldersbrook had caused the flooding. Defendants could not have foreseen that, in such a short space of time, there would be this tremendous downfall of rain, exceeding all past experience, and that the water would be found in the Aldersbrook instead of in the Roding. It was not even suggested that defendants ought to have done anything different from what they did in cutting and reinstating the bank for the purpose of laying the main. In conclusion, he submitted that the injury was caused through an act of God—viz., the tremendous and unprecedented rainfall.

Mr. LUSH, in replying upon the whole case, maintained that the flooding was caused through the negligence of defendants in damming the Aldersbrook, cutting the river bank, blocking the culvert, making a pond, and raising the wall, thereby making the pond much larger. He thought no one could have the smallest doubt that what defendants had done in this blundering manner was the whole cause of the disaster which ensued, and that it was not in any way attributable to the act of God.

Wednesday, July 12.

His LORDSHIP, in summing up, said a great many points had been raised during the trial which were not material to any particular issue—as, for instance, the date when the dam was put below the Aldersbrook arch. The broad question which the Jury had to decide was whether or not, in doing what the defendants did to the bed of the Aldersbrook, they acted negligently and with want of reasonable care, and whether the damage suffered by the plaintiffs was occasioned by this want of reasonable care. There was a subsidiary question as to whether, in putting an obstruction in the water-course, they were creating what in law was called a nuisance. The law was very plain upon the point. If a person took a dangerous engine along a high road, or made a dangerous construction interfering with a public high road, he would be responsible, whether he was negligent or not, if damage was occasioned thereby; but if an Act of Parliament said this might be done in the interest of the public, then the people who did the act were not liable if they had exercised reasonable care. He advised the Jury not to let little things affect their mind so much as the broad features of the case. The most important thing to consider was, What was the position of the two water-courses before 1899, when the Gas Company obtained parliamentary power to interfere with them. It was unfortunate that they had no accurate or detailed plan showing what the position originally was; but from the plan deposited when the Company went to Parliament in 1899, the general condition was clearly indicated. There were two streams—the Roding and the Aldersbrook—which joined together and went through separate bridges; and at some time or other a cut was made on the north side of Romford Road. Then there was a permanent barrier or embankment at a level of 22 feet constituted by the Romford Road, through which two openings were made; these being connected with the cut. What could this have been made for? All the witnesses agreed that the function of the combined system was that each bridge should relieve the other in time of flood, as there was no other outlet for water up the valley. Before 1899, the floods were dealt with by a system of very ancient construction, which allowed the water at low tide to go through the Roding, and when there was a flood to go through the Aldersbrook; and when it was desirable to have the two bridges, to relieve one another, there was a direct cut to enable the water to pass from one to the other. The area of the three arches over the Roding was 329 superficial feet; the height being 18 ft. 3 in. The area of the Aldersbrook arch was 127 feet; the crown being 2 feet lower than the Roding arch. Everyone agreed that, when the water in the Roding rose 2 feet, it would begin to flow through these arches; and when it rose to the crown of the arch, it would be 6 ft. 8 in. above the bed of the Aldersbrook, and there would be an immense rush of water through the cut. This was the condition of things when the defendants interfered with it; and when they interfered under statutory powers they had to do so reasonably, exercising all care and caution to prevent their acts doing harm to other people. Now there was a serious conflict between the parties as to what occurred below the bridge. It appeared that there was a vast area of low-lying land protected by a river bank 17 ft. 6 in. high; and there was no doubt that, before the gas-works came at all, when there was a flood the island was to a large extent submerged—the water going down the Roding and the Aldersbrook and over the land. The difficulty was that the defendants had altered the configuration of the ground, not only by doing what they did under the powers of the Act of 1899, but also by raising from time to time the level of the island in many places. The parliamentary plan more than confirmed the evidence of Mr. Campbell (who was called on behalf of the plaintiffs) that there was no construction which would check back the water in the Aldersbrook; and no one suggested that, prior to this event, the Aldersbrook, as such, had been found insufficient to take away the water. It would be for the Jury to ask themselves the question, "Was the Aldersbrook sufficient before the defendants interfered with it (whatever the height of the land from the bridge to the junction) to take away the water which came through the Aldersbrook bridge? Their Act gave the Gas Company power to close, fill in, and appropriate, and use the bed and channel of the Aldersbrook south of the bridge, provided they maintained a cut or culvert not less than 4 ft. 6 in. from the Aldersbrook to the Roding. It had been said on plaintiffs' behalf that the defendants had no right to fill in the bed of the Aldersbrook so as still to let flood water come through the arch—that it was bad engineering to fill up the bed without making an outlet. It was not for the Jury to decide against the defendants because they did this afterwards, but simply to consider the evidence as to what they ought to have done. Mr. Campbell said it was bad engineering not to have closed the arch; and Sir Alexander Binnie said: "My objection is damming it up below the bridge without making a corresponding outlet; if the water got through the Aldersbrook arch, there would be no flooding over the submerged area." If the case stood there, the onus to rebut it would be upon the defendants; and Mr. Bryan, the Engineer to the Metropolitan Water Board, whom they called, when asked whether he thought it was a prudent thing to put a dam across without blocking the arch, said he would rather not express an opinion. There was no doubt that if the defendants could have called engineers to contradict Sir Alexander Binnie they would have done. It was said that, as soon as the June flood had taken place, so obvious was the necessity to close the arch that the defendants did it; and the Jury ought to hesitate a long time before disbelieving the defendants' evidence upon this point. One had not to consider what was done afterwards, but what ought to have been done before. Having directed attention to the point about cutting the river bank to lay the main, to the contentions on both sides as to the way in which the work was done, and to the abnormal rainfall in June, his Lordship said that if the Jury thought the flood was one which could not reasonably have been foreseen, they would so find; but they must remember that it was not a question of the amount of water above the Romford Road, but whether the flooding was caused by the act of God.

The Jury, after consulting in private for an hour-and-a-half, answered the questions left to them as follows:—

Were the defendants guilty of any negligence or want of reasonable care: (*a*) In reinstating the river bank after the laying of the mains in 1901?—Yes. (*b*) In closing, filling in, and appropriating the bed and channel of the Aldersbrook?—Yes.

Was the flooding of the plaintiffs' land occasioned by such negligence or want of reasonable care in respect of (*a*) or (*b*) or both (*a*) and (*b*)?—Yes, both.

Was the flooding of the plaintiffs' land due directly and exclusively to natural causes, and was it such as could not have been prevented by foresight, pains, and care reasonably to be expected of the defendants?—No.

A further question put was: Did the defendants create a nuisance upon their property, and was the flooding of the plaintiffs' land occasioned by such nuisance? Having regard to the answers to the other questions, it became unnecessary to reply to this; and by consent the Jury were relieved from answering the last question—Did the defendants within three years from June, 1899, close any part of the Aldersbrook south of the Aldersbrook bridge?

On the above findings, his Lordship entered judgment for the plaintiffs, and declined to grant a stay. The question of the amount of damages will be settled by the Official Referee.

HIGH COURT OF JUSTICE—CHANCERY DIVISION.

(*Before Mr. Justice* WARRINGTON.)

Friday, July 21.

Warren v. Lambeth Water-Works Company—The Proposed Gratuity to Servants.

This was a friendly action brought by a stockholder against the Lambeth Water Company and the Directors to determine the question whether the latter could properly distribute a sum of £8000 out of the compensation paid to the Company by the Metropolitan Water Board as a gratuity to the officers and workmen who had been in the service of the Company for not less than three years. The question turned mainly on the wording of the scheme drawn up in accordance with Schedule 4 of the Metropolis Water Act, 1902.

Mr. DANCKWERTS, K.C., and Mr. VAUGHAN HAWKINS appeared for the plaintiff; and Mr. ROWDEN, K.C, and Mr. R J. PARKER represented the defendants.

Mr. DANCKWERTS, in opening the case, said that when the Metropolitan Water Board was constituted, a scheme had to be framed for disposing of the compensation-money paid to, and the winding up of, each Water Company. What had happened in the present case was that the compensation had been paid, and the greater part of it distributed; but there was a sum of £41,000 cash remaining, which had to be distributed among the shareholders subject to certain disbursements. The proposition was that a gift should be made to certain servants who, on June 24, 1904, had been in the employ of the Company for a period of not less than three years. The plaintiff, who was a stockholder, objected to this. The statement of claim set forth that by the scheme drawn up it was declared that the Directors should retain the sum of £41,000, and apply it to the following purposes: (1) In the payment and discharge of any liability; (2) in payment of the sum of £7350 voted by the Company in general meeting in recognition of special services rendered; and (3) in the payment of all costs, charges, and expenses incurred or to be incurred in or in connection with the application and distribution of the compensation-money and the winding-up of the Company. This was the clause in question; and there was nothing in it enabling anything to be paid by way of gratuity. The existing servants and officers of the Company had, for the most part, been taken over by the Water Board; and those who were not had received the compensation awarded to them under section 47 of the Act. At a meeting of the Directors held on March 7, a letter from Mr. Stephen A. Jones with reference to a suggested gift to the staff, together with memorials from the workmen for a bonus, having been considered, it was resolved that a sum not exceeding £8000 be voted for the general remuneration of officers who had been in the service of the Company for three years and upwards at the "appointed day," and who had not participated in the grant for special services referred to in the scheme. The plaintiff submitted that, under the Act and scheme, such application of the compensation-money was illegal and improper; and he therefore asked for an injunction to restrain them from appropriating any of the £41,000 for the purpose named. The defendants had put in a defence which was intended to admit the statement of claim, so that the facts might be before the Court.

Mr. ROWDEN submitted that the decision come to by the Directors, at the suggestion of a large body of shareholders, was within their powers. His case was that this fell within clause 3 of the scheme. Looking at the matter from an equitable point of view, no one who participated in the £7350 was to have any share in the £8000, and no one who had a share in this would have any in the £7350. He contended that what the Directors proposed was clearly within the expression "including the remuneration of any officers of the Company for their services in or before or after the transfer of the undertaking." It must not be read as services in connection with the transfer. The Company had been very successful, and the Directors wished to reward their servants for assisting in bringing about this prosperity.

After further legal argument,

Justice WARRINGTON said he need not trouble Mr. Danckwerts to reply. He sympathized with the desire of the Directors to make gratuities to their servants; but what he had to decide was whether in law they were entitled to do so. There were two things to be noted in connection with the resolution of the Directors. First, the payment was treated as exclusive of the amount required for the costs, charges, and expenses incurred or to be incurred in or in connection with the application and distribution of the compensation-money and the liquidation of the Company. Secondly, that it was in express terms not a grant for special services, because it was to be made to those only who had not participated in this particular grant. Two questions arose on this. First, was this authorized by the words of the scheme? If so, was the scheme going in this respect beyond the powers of the Company as defined and embodied in the Act of Parliament? He thought the true meaning of clause 3 was that the remuneration there provided for was remuneration for services in connection with the application and distribution of the compensation money and the liquidation of the affairs and the winding-up of the Company. The proposed application of the £8000 did not, in his opinion, come within the scheme. If clause 3 enabled gratuities to be paid, it would go beyond the special provision contained in Schedule 4 to the Act of 1902, and could not be supported by the general powers of the Company. On either way of looking at the question, it seemed to him that what the Directors proposed to do could not lawfully be done.

Mr. DANCKWERTS said it had been agreed that the motion should be treated as the trial of the action, and therefore there would be judgment for the plaintiff for a declaration as claimed and costs.

A MAGISTRATE AND THE WATER BOARD'S METHODS.

The action of the Metropolitan Water Board in cutting off the supply to some premises in Mile End was the subject of some strong remarks on the part of Mr. Cluer, the Magistrate sitting at Worship Street, last Thursday. The Board were summoned by Walter Tobin, the owner of No. 32, West Street, Mile End, under section 43 of the Water-Works Clauses Act, 1847, for "neglecting and refusing" to furnish the premises with a supply of water. Mr. Kebbell, for the plaintiff, explained that the supply was summarily cut off without notice on May 31; and only after this had been done was it formally intimated that the reason was a leakage. Under any circumstances the discontinuance of supply to a dwelling-house required notice by the Board to the Sanitary Authority of the district; and this was not given. In the course of the case for the plaintiff, evidence was called to prove the tendering of the water-rate in advance as from June 14. For the defence, it was stated that, in consequence of a leakage in the connecting-pipe to the house, the roadway was opened, and the service-pipe disconnected and closed. The waste was equal to 30 gallons a day; and the cost of re-instatement was put at close upon £2. Mr. Collins, who defended, argued that under their Special Act the Board were entitled to cut off the water in certain eventualities, one of which was an owner's failure to repair defects. He submitted that the Board could cut off without notice, and in support of his argument quoted the case of the *Grand Junction Water Company v. Easton*, decided by the King's Bench in 1902. Mr. Cluer asked how the leakage was to be discovered by the owner when it was outside the house, and said Mr. Collins's interpretation of the judgment was wrong. Mr. Collins persisted that there was no obligation to give notice. Mr. Cluer: You will find there is. It is perfectly childish to argue that. I should like to know who are the juvenile—I might say infantile—persons who advise the Water Board in this way. Mr. Collins said it was what the Solicitors to the Board construed as the law. Mr. Cluer: Well, this is a most discreditable piece of ignorance displayed by the gentlemen who instruct you for the new Water Board. Mr. Collins: The other defence is that the rate for the water was in arrear. Mr. Kebbell pointed out that the rate was paid on June 14; and the date complained of in the summons was June 15. Mr. Cluer: The cutting off was on May 31. If the rate was in arrear at that time, I am afraid you are out of Court. Mr. Kebbell: I cannot prove the rate was paid up in advance. Mr. Cluer: Then the summons must be dismissed, and I say it with great regret; for I would have made the Water Board pay the full penalty—£10.

Liability for a Gas Explosion.

At the Birmingham County Court recently, before his Honour Judge Whitehorne and a Jury, an action was commenced which arose out of a gas explosion that occurred in the city last Good Friday, as reported in the JOURNAL for May 2 (p. 326). The explosion, which took place in a screw factory at Balsall Heath, did considerable damage to surrounding property, and injured several persons; and the present action was brought by a brassworker named Henry Pruitt, who lived at the back of the premises, to recover damages for injuries to his wife and daughter and damage to his house and tools. Plaintiff estimated his material loss at £10, and left it to the Jury to say how much he was entitled to on account of the discomfort and pain caused by the damage and injuries. The defendant, Ephraim Phillips, denied responsibility for the effects of the explosion, and stated that the escape of gas which caused it originated in the lower part of the premises, occupied by another firm. Mr. Phillips suggested that the gas came up the chimney and was ignited by the fire in his office. On the other hand, it was stated on behalf of the plaintiff that the explosion was due to negligence on the part of defendant's foreman, who, knowing that there was an extraordinary quantity of gas escaping, went to look for it in broad daylight with a piece of lighted paper. Ultimately a settlement was arrived at on terms which were not disclosed.

Gas as a Means of Self-Destruction.—A well-known Wakefield architect (Mr. Arthur Fawcett) has just died as the result of an attempt to poison himself by gas more than a month ago. On his assistant going to his office on the morning of the 17th ult., he found the door of the private room locked. There was a very strong smell of gas; and on the door was a piece of paper on which were written the words, "Don't strike a light." On the room being entered, deceased was found sitting near his desk, clasping in his hands a tube connected with one of the gas-jets. His nostrils had been plugged with wads of cotton wool; and the fireplace had been covered with a rug. He was brought round, and for a time it was thought he would recover; but eventually he became worse, and died. It is stated that Mr. Fawcett had been depressed since the death of his wife.

The Water Supply of Skipton.—Skipton is at the present time undertaking an extensive water supply scheme which is estimated to cost £72,000, and will take five years to complete; but the shortage of water in the town has recently been such that power was obtained to provide a temporary supply. This has been done, and the turning-on ceremony was performed last week by Mr. I. Williams, the Chairman of the Water Committee, who entertained the members of the Council to tea; while Mr. W. Farey, the Chairman of the Council, subsequently gave a dinner in celebration of the event. The scheme has been carried out by Mr. J. Mallinson, the Surveyor and Water-Works Engineer to the Council; and the idea throughout has been to make the work as far as possible part of the permanent arrangement. A pipe-line has been laid from the existing reservoir to Embsay Moor (the new gathering ground); and at the foot of the moor the main stream has been impounded by a small stone weir, whence the water will flow by gravitation to the reservoir. The cost of the work (which it is expected will tide the town over the five years that will elapse before the permanent scheme is completed) has been £12,500.

Hoylake and West Kirby Gas and Water Company.—At the meeting of the Hoylake and West Kirby Gas and Water Company on the 31st inst., the Directors will report that the working of both portions of the undertaking continues to be satisfactory. While there has been no shortage in the water supply, the Board are fully alive to the possible further development of the district; and they are now sinking a trial boring at Newton, which, if successful, will prove a valuable addition to the Company's resources. The gas-works have been to some extent remodelled during the past season; obsolete plant having been disposed of, and additions having been made where required. It is expected that such improvements will result in economies and greater convenience in working the undertaking. A reduction of 1d. per 1000 cubic feet (by way of a discount for prompt payment) came into force as from Oct. 1 last. The dividends recommended, with the interim distribution, will represent for the year to June 30 the following rates, less income-tax: Gas capital, "A" original, 11 per cent.; "B" additional, 8 per cent. Water capital, "A" original, 10 per cent.; "B" additional, 7 per cent. The net revenues for the year were: Gas, £2695; and water, £4463. The total income, including the amounts brought forward, was £7785; and after payment of the dividends, and the transfer of £950 to reserve and contingency funds, there will remain a balance of £769 to be taken to the next accounts.

MISCELLANEOUS NEWS.

THE ILLUMINATING POWER OF GAS IN EDINBURGH.

Report by Mr. W. R. Herring.

The subjoined report by Mr. W. R. Herring, the Chief Engineer and Manager of the Edinburgh and Leith Gas Commissioners, was laid before the Board at their meeting yesterday. Its consideration was deferred till Sept. 11.

At a meeting of the Works Committee held in the Board Room on Monday, May 8, 1905, the Engineer was instructed to consider the remit, on the motion of Councillors Wilson and Maxton, "to consider whether, having regard to the large and increasing use of gas for heating, cooking, and with the incandescent mantle for lighting, the time has now come for obtaining powers to reduce the candle power of the gas, and report to the Committee."

In order to deal properly with the question raised in the foregoing remit, it will be necessary to consider the subject from various points of view, to permit of a proper understanding of what is admittedly a complicated subject. I therefore propose to deal with it under several headings.

I. *The General Practice with regard to the Illuminating Power of the Gas.*—The general practice of gas administrators throughout the country for some years past has been to abandon the artificial enrichment of coal gas, and to manufacture a gas of such illuminating power as is yielded from the common coal available in the particular locality in question, or such as is commercially advantageous to import into that locality. The economic advantages of such a policy are undoubtedly sound; and the fact that 15-candle gas is a satisfactory supply to most English towns, proves that its practical utility is also beyond question. Parliament has, in connection with Private Bill Legislation, also given its approval to this policy, and in many instances has enacted a lower illuminating power for various districts of supply where formerly enrichment was resorted to in order to uphold what might be termed an artificial illuminating power of the gas supply. The general policy, therefore, may be declared to be in favour of a reduction of the illuminating power of a town's gas supply.

II. *High versus Low Grade Gas.*—By this I desire to contrast the practice of Scotland with that of England. In England, the average illuminating power may be said to be 15 candles; whereas in Scotland it averages nearer 25 candles. First, let me define what is meant by the illuminating power of a gas. This is clearly defined in the Gas-Works Clauses Act and other statutory enactments relating to gas supply. The standard illuminating power of any gas is based on the assumption that it has been burned at the statutory rate of 5 cubic feet per hour. It is therefore only (say) a 25-candle gas when it is burned in a suitable burner at the statutory rate of consumption. If less gas is burned, a lesser illuminating power results; nor is the fall in the illuminating power in proportion with the fall of consumption. On the contrary, it descends at an increasing ratio, as a consequence of the physical conditions surrounding the ordinary flame adversely affecting the smaller flame to a greater degree than the larger flame. For instance, take our public lamps, with their 2 feet per hour flat-flame burners, these, burning under their very best conditions, yield only from 4 to 5 candles of illumination with the burners it is necessary to use to yield a flame unaffected by the draughts to which the lanterns are subjected. By burning the same quantity of gas in another burner, suitable for indoor lighting, from 5½ to 6 candles of illumination per 2 feet of gas can be obtained. With the flat-flame type, the average consumption per burner may be taken at 3 feet per hour, and may be stated to yield about 13 candles of illumination—burning with a new and clean burner. A dirty and worn-out burner of the same class yields a lesser light down to almost *nil* with the same consumption of gas. On the other hand, an argand burner, especially made to suit the Edinburgh gas, may yield as much as from 16 to 17 candles with the same consumption of gas. It is therefore important to remember that the stated illuminating power of any gas pre-supposes the most efficient burner burning the gas at the statutory rate of consumption. That these results are not achieved by the public is admittedly a fact—not, however, because the gas is bad, but simply because they persist in using improper, old, or defective burners. There is another important influence affecting the apparent illuminating power of the gas—that is, the conditions of supply in the particular house or district. The distributory system, with all its ramifications, at times becomes deficient, as a consequence of the extension of the gas supply area and the demand for gas into new districts. For some years past care has been taken to see that the piping laid to and through new property is not only being properly laid, but of a sufficient size to ensure a satisfactory supply of gas for all purposes. Gas, like water, will flow through the easiest course, and will pass through a large pipe in preference to squeezing its way through a small one. Considerable extension of the distributory system, in the form of trunk mains surrounding the outer districts, carrying high-pressure gas, has been recently completed, which now forms an irregular semi-circle, projecting from Granton southwards, *viâ* Morningside and through the centre of the town to Holyrood, and *viâ* Duddingston to Portobello. In any district that is now discovered to be deficient in its supply, the supply can be augmented by a connection with this high-pressure system, by means of an underground governor placed under the road surface; and a considerable number of such connections have already been made. There is, however, even now in some parts of the New Town, as well as the Old Town, local deficiencies which only manifest themselves during the periods of heavy consumption in the locality. This arises primarily as a consequence of the small piping within the houses themselves which, when the full pressure exists in the distributory system, is sufficient to supply all the gas required, but during the heavy lighting period of the evening, when the pressure, sufficient in itself for all practical purposes, is yet insufficient to supply these narrow and restricted pipes. Hence the consumer observes the gas to be bad during the earlier part of the evening, and better during the latter part of the evening. Such defects can be remedied as soon as we are acquainted with their existence. But, unfortunately, the public do not always assist us by communicating direct.

III. *Loss of Illumination by Distribution of High and Low Grade Gas.*—A point of considerable practical importance to the consumer is the permanency of the gas during the process of distribution through the interminable ramifications of the piping system throughout the area of supply. We manufacture a gas of from 24 to 26 candles at the works; this quality having been determined by the Commissioners on the 25th of September, 1893. The English practice is to supply a gas of from 15 to 16 candle power; and I have myself had experience with the manufacture and supply of gases of 14, 16, 18, and 20 candle power in various parts of the country. The lower-grade gas may be said to be permanent in transit. There is, however, a tendency for the higher-grade gas with cannel coal enrichment to lose some portion of its illuminants while travelling through the mains—the proportion varying with the prevailing atmospheric conditions and the chemical composition of the gas. To properly appreciate the cause of this, it is necessary first to remember that all gases—even the air we breathe—are capable of being reduced from the gaseous to the liquid state under certain physical conditions. Illuminating gas produced from coal and cannel consists of a mixture of many different gases; the principal ingredients being the following, which contrasts the average composition of the Edinburgh gas with the average composition of what may be termed the English gas:—

	Edinburgh Gas. 25-Candle Power. Per Cent.		London Gas. 15-Candle Power. Per Cent.
Carbonic anhydride	0·2	..	0·12
Heavy hydrocarbons	9·2	..	3·83
Oxygen	0·2	..	0·00
Carbonic oxide	10·8	..	6·61
Methane (marsh gas)	37·1	..	33·90
Hydrogen	36·6	..	48·49
Nitrogen and inert gases	5·9	..	5·05
	100·0		100·0

The constituent which is light-yielding in both gases is the heavy hydrocarbons of the olefine series; the other gases being mostly heat-yielding, excepting the carbonic anhydride, the oxygen, and the nitrogen, &c., which are mostly diluents. That is to say, that if the heavy hydrocarbons were not present in the gas, it would burn with a non-luminous flame, but would in itself be quite suitable for use with the incandescent mantle, or for heating and gas-engine purposes. From the statement of the analysis already given, it will be seen that the proportion of light-giving constituents is much larger in the Scottish gas than in the English gas—some 140 per cent. greater. These are the only gases that are liable to be affected by atmospheric conditions. In other words, they are the gases that are liable to condense in the distributory system, while the others would all pass forward. With the English gas, therefore, 96·17 per cent. is absolutely permanent gas, and that 96·17 per cent. of permanent gas has to carry and keep in suspension 3·83 per cent. of gases that are likely to condense and fall out. With the Edinburgh gas we have only 90·8 per cent. of absolute permanent gas, and 9·2 per cent. that is affected by atmospheric influences; so that the Edinburgh gas carries 140 per cent. more of the delicate illuminants which are so seriously affected by atmospheric conditions. It is, therefore, no wonder that the 25-candle gas is less permanent in its character than the 15-candle gas referred to. The above remarks refer exclusively to cannel coal enrichment. Carburetted water-gas enrichment is more permanent in its character; but we are unable commercially to rely upon carburetted water gas as a permanent source of enrichment of the gas we make.

Upon first taking up my duties under the Commissioners, I was careful to fully investigate the whole of the conditions I found existing at the works, and in the district of supply; and, among others, I paid particular attention to the carrying power or permanency of the gas supplied, making separate investigations as between the gas manufactured at Leith and the gas manufactured at the Edinburgh works. From November, 1900, the investigations were continued through December, and into January, February, March, April, May, June, and July of 1901. The Edinburgh gas, in travelling through the pipes from New Street, a distance of 1·56 miles, to Glenogle Road gasholder station, during the winter period from November to February, lost in transit 4·715 candles. The Leith gas, in travelling through the mains, a distance of 1·86 miles, to Glenogle Road gasholder station, lost 5·28 candles. Making similar investigations with regard to the gas manufactured at Granton, but testing at New Street instead of Glenogle Road, in October of 1903, the gas travelling through the pipes, a distance of 4·3 miles, lost in transit 2·33 candles; and in November there was a drop of 3·13 candles. Owing to great pressure of other work at this time, I was obliged to abandon these investigations until September of last year, since which date the records have been consistently kept. The average loss during this period, on the gas travelling from Granton to New Street, a distance of 4·3 miles, has been 2·43 candles; and during the same period, by tests at the station near Holyrood, it is found that the gas remains permanent between these two points. Personally, I am of opinion that for all practical purposes the loss may be considered complete on the arrival of the gas at the Tanfield gasholder station. As the district of supply is now fed directly from the high-pressure mains, the actual loss to the public is not necessarily as much as these figures show.

The illuminants lost as a consequence of the distribution of high-grade gas is found in the liquid form in the street syphons, of which we have some 1500 in various parts of the district of supply. It will be noted, from the figures already given, that the gas manufactured at Granton is of a much more permanent character than the gas as formerly manufactured at the old works. This is merely as a consequence of the type of plant being suitable, and its capacity sufficient to deal with the gas properly. A loss of illuminating power, however, with high-grade gas is inevitable; and seeing these illuminants are put into the gas at considerable cost—some of them only to be removed from the street mains, also at some cost—it is a point of considerable importance, and one that should be duly considered in dealing with the pro-

posal embodied in the minute. Stated shortly, the lower the illuminating power of the gas the more permanent it is under conditions of distribution and atmospheric influences. If it were determined to manufacture a 20-candle gas at the works, it would not only result in some economy in the manufacturing costs, amounting to from £10,000 to £12,000 per annum, but, so far as my experience and judgment enables me to determine, I would anticipate being in a better position to guarantee the delivery of a gas approximating 20 candles at the point of combustion. Under any circumstances, the 20-candle gas would be much less affected by the rapidly changing atmospheric conditions; and, consequently, a gas of a more uniform quality would be delivered to the consumers. It is not so much the initial quality of the gas that the consumer observes as the varying quality of it. One day, owing to the mild temperature, the gas carries its full power, and in some cases even takes up illuminants that have already been deposited in the mains; while the next day, owing to a reduction of atmospheric temperature, there may be as much as several candles difference in the illuminating power reaching the consumers' burners, notwithstanding that additional efforts are made at the works to counteract these adverse influences. The only practical way of proving this point is to run the works on the manufacture of a 20-candle gas for (say) one year.

IV. *Illuminating Power and its Relation to the Heating Value of a Gas.*—The heating value of a town's gas supply is now of supreme importance to all consumers, as it affects the light given by the incandescent mantle, the gas-cooker, gas-fire, and the gas-engine alike. Some variation in the heating value of a gas, however, is not important when the gas is burned in the old-fashioned flat-flame burner. In England, this has been very much debated before Parliament in recent years; but as the question at issue in the south only has reference to the reduction of the illuminating power by one or two candles, its importance is not of any real practical value. When, however, we propose to deal with the richer gases produced mostly from cannel coal, the difference between a 25-candle and a 15-candle gas is somewhat important in this respect. It is a fact that less of the Edinburgh gas is required than of the English gas to yield the same amount of light from an incandescent burner, as a consequence of the higher-grade gas having a higher heating value than the lower-grade gas. The heating value, however, is not in proportion to the illuminating power. For instance, the 15-candle English gas has a gross calorific value of 570 British thermal units, and the 25-candle gas 690 British thermal units; the illuminating power being 66 per cent. more, but the calorific value only 21 per cent. more. The increased value in the illuminating power does not, therefore, give the consumer an equivalent advantage in the heating power of the high-grade gas. The calorific power of coal is a question that is now only being scientifically dealt with in a systematic manner; and while I have been able to compile a mass of information relative to this issue, I am not, at the moment, prepared to embody it in a short statement summarizing the investigations in a phrase. There are so many highly scientific and delicate issues involved, every coal yielding a gas of a slightly different character, which apparently has a very important influence upon the calorific or heating power of the gas. The relations between illuminating power and volume of flame, flame temperature, and oxygen required to produce combustion, have all yet to be determined in their relation to one another; and I am afraid some years must elapse before any emphatic finding can be given on this issue.

V. *Commercial Aspects of Lowering the Illuminating Power of a Town's Gas Supply.*—In England, the reduction in the illuminating power of a town's gas supply is of considerable commercial importance, as a consequence of the enriching materials being expensive in their character—principally as a consequence of their having to be transported in the form of cannel coal from Scotland to England; although other enrichers, such as oil and spirit, carburetted water gas, &c., have more lately come into vogue. The artificial enrichment of the gas produced from a coal that is found commercially advantageous to buy in any locality is, however, commercially unsound and uneconomic in principle, as the illuminating power obtained depends upon the volume of the gas burned, and not upon its illuminating power—speaking now of the flat-flame or argand burners—and it is a simple calculation as to whether it is advantageous to burn a little more of the low-grade gas, or less of a high-grade gas to acquire the illumination desired. The introduction of the incandescent burner renders the problem still more easy of settlement—the incandescent burner depending upon the volume of flame, *plus* the flame temperature, for its efficiency; and while, generally speaking, less of a higher-grade gas is required to give the same illumination with the incandescent burners than of a low-grade gas, it does not necessarily follow that the high-grade gas is the more economical of the two, particularly when the high-grade gas must be produced from materials comparatively expensive in their character. These remarks are particularly applicable to the greater part of England, although there are works in the vicinity of cannel coalfields in Lancashire and Yorkshire to which they would not apply. It may also be said that they apply with equal force to many Scottish towns far removed from the cannel coalfields; but the position of Edinburgh is unique in this respect. Geographically it may be said that Edinburgh is now the centre of the rich cannel coalfields of Scotland, and that, consequently, their transport to the works is represented by a very low railway rate. In dealing with this matter some five years ago, my report, contained in the minutes of the 29th of July, 1901, showed that the prevailing commercial conditions during the preceding period of six years would only permit of our reducing the price of gas by 1·76d. if it were reduced to 20 candles, and 3·37d. if it were reduced to 15 candles.

I have again considered this aspect of the question, and, taking all things into consideration, I find, dealing with the commercial conditions of the past three years, that a 20-candle gas could have been supplied at 1·64d. less than the 25-candle gas was supplied at. This 1·64d. per 1000 feet represents a total saving of £13,500 per annum on our present make of gas—a sum that might very advantageously be applied to the liquidation of the capital on the old works. We could not offer to the consumers any monetary advantage as the result of such a policy. There would, however, be one or two distinct practical gains. In the first place, owing to the gas being of a more stable character, a more uniform quality of gas would be supplied throughout the entire district, and, consequently, the variations now caused by sudden atmospheric changes would not be observable by the gas consumers. These variations are of considerable annoyance, as a consequence of the adjustment of the now almost universally used incandescent burner. The proportion of air and gas must be adjusted in these burners for a certain grade of gas, and when this grade changes, as a consequence of atmospheric conditions, if the illuminating power falls, the air supply is in excess of what is necessary, and reduces the light of the burner. On the other hand, if the illuminating power rises above the normal, the air supply is insufficient, and causes a blackening of the mantle, and consequently a reduction of light; and also sometimes the destruction of the mantle itself. The only way to satisfactorily settle the doubtful points at issue would be for the Commissioners to sanction a one-year's trial of a 20-candle gas.

VI.—*Existing Statutory Powers.*—The Commissioners' statutory powers, embodied in their Act of 1888, prescribes that the illuminating power of the gas supplied shall not be less than 20 candles. Clause 77 prescribes the burner. Clause 78 prescribes that the testing place or places shall be some part of the works of the Commissioners, or such other place as the Commissioners may determine. It will, therefore, be seen that no additional powers are necessary to enable the Commissioners, should they so determine, to immediately proceed to supply a 20-candle gas.

THE PAST YEAR'S OPERATIONS AT MANCHESTER.

A Satisfactory Report.

The Gas Committee of the Manchester Corporation last Friday held a special meeting for the consideration of the report and accounts of the Department for the year to March 31; and we have since received copies of the documents from Mr. Charles Nickson.

The number of tons of coal and cannel carbonized (including the equivalents of enriching materials) was 456,710 tons, as compared with 458,864 tons in the previous year; the quantity of gas made per ton being 10,967 cubic feet, against 10,868 feet. The quantity of gas sent out from the works (4,998,456,000 cubic feet) shows an increase of 4,220,000 feet, or 0·08 per cent., as compared with an increase of 157,235,000 feet, or 3·25 per cent., in the preceding year. The quantity of carburetted water gas produced during the year was 1,110,866,000 cubic feet, as compared with 1,159,730,000 cubic feet in the previous year. In the production of this gas, 3,415,294 gallons of oil and 21,275 tons of coke were used, as against 3,682,403 gallons and 22,403 tons respectively for the year ending March, 1904. The illuminating power of the gas sent from the works was equivalent to 17·04 standard sperm candles, as against 17·80 candles. The unaccounted-for gas was only 2·88 per cent., which compares with 3·71 per cent. for the previous year.

The number of consumers on March 31 was 152,165, of whom 18,087 were outside the city. In the previous year the number was 146,457, of whom 29,753 were outside the city. While the total increase was thus 5708, there was an increase of 17,374 consumers within the city, and, of course, a decrease of 11,666 outside. Lest there should be any misunderstanding with regard to these figures, it should be pointed out that the Withington and Moss Side urban districts were incorporated in the city on Nov. 9 last, which accounts for the fact that there are now a smaller number of consumers outside. Of the total consumers, 47,865 use prepayment meters. This compares with 44,341 in the previous year—an increase of 3524; and of this increase 2980 have been fixed in the city and 544 in the out-townships. The quantity of gas passed by these meters was 388,909,000 feet, or an increase of 12,895,000 feet, or 3·43 per cent., on the previous year. The meters have been inspected once in every five weeks; and the amount collected during the year was £54,550 6s. 11d. This is represented by 13,092,083 pennies, weighing 116 tons 17 cwt. 3 qrs. 13 lbs. The number of gas-cookers and other appliances fixed at March 31 was 23,862, compared with 17,722 for the year ending March, 1904. The quantity of gas consumed by cookers, fires, &c., is estimated at 350,000,000 cubic feet; being an increase of 70,000,000 feet, or 25 per cent., on last year's figures. There have also been fixed 22,963 grillers in connection with prepayment and small ordinary meters. On March 31 last the number of gas-engines in use was 1711, as compared with 1625 in the previous year. The quantity of gas consumed by these engines was 386,982,000 cubic feet, an increase of 22,000,000 feet, or 6·03 per cent. In accordance with the resolution passed by the City Council in May, 1904, the price of gas to ordinary consumers was reduced from 2s. 6d. to 2s. 4d. per 1000 cubic feet within the city, and from 2s. 9d. to 2s. 7d. without the city, as from June 24 of that year. A further reduction of 1d. per 1000 cubic feet to ordinary consumers took effect as from June 24 this year, in accordance with the resolution passed by the Council on May 3. The cost of coal, cannel, and oil per ton carbonized was 10s. 8·85d., as against 11s. 3·65d. for the previous year, a reduction of 6·8d. per ton, which on the total carbonization of 456,710 tons amounts to £12,940.

The total income was £688,954, and the expenditure £538,164. The gross profit on the year's working was £150,789. The sum of £42,112 was paid for interest, and £42,609 has been placed to sinking fund, as required by the Acts of Parliament under which the loans were raised. The net profit therefore amounted to £66,067, which has been appropriated as follows: Paid over to city fund, £60,000; extension of carburetted water-gas plant, £48; extension of Whitworth Street West depôt, £897; extension of chemical works, Bradford Road, £85; purchase of consolidated 4 per cent. stock for cancellation, £3131; Middleton Corporation, in consideration of Heaton Park area gas supply, £293; reserve fund account, £1613. With the addition thus made to it, the reserve fund stands at £147,608. The total length of mains now laid is 1,510,663 yards, or 858¾ miles 143 yards; being an increase of 15 miles 308 yards during the year. The number of public lamps

within the city is 17,361, and without the city 2078—a total of 19,439, of which 5866 within the city are fitted with incandescent burners.

The following are the principal items in the accounts :—

REVENUE ACCOUNT.

INCOME.

Gas-rental—			
Ordinary meters		£471,292 0 5	
Prepayment meters		54,550 6 11	
Public lamps		47,823 13 2	
Residual products—			
Coke	£60,603 10 1		
Tar	20,735 19 8		
Sulphate of ammonia	33,318 1 10		
Carbon	186 13 7		
		114,844 11 2	
Rents of cottages, &c.		443 2 8	
		£688,953 14 4	

EXPENDITURE.

Cannel, coal, and oil (including cost of unloading, &c.)	£245,200 6 7
Coke, water, &c. (carburetted water gas)	8,963 12 10
Carbonization (retort men's wages)	41,952 11 2
Purifying material and wages	5,600 3 8
Retorts, fire-bricks, &c.	8,169 3 7
Repairs and maintenance of works, mains, &c.	74,903 0 2
Renewals of plant, &c.	49,000 1 0
Salaries and wages of Engineer, clerks in Superintendent's office, rental and inquiry offices, and meter inspectors, &c.	36,420 14 2
Collectors', receivers', and cashiers' salaries	8,957 8 11
Rents, rates, and taxes	50,450 1 1
Compensation under Workmen's Compensation Act, 1897	86 8 11
Bad debts written off	875 12 2
Miscellaneous expenses	7,584 16 11
	£538,164 1 2
Balance carried to the profit and loss account	150,789 13 2
	£688,953 14 4

PROFIT AND LOSS ACCOUNT.

Interest	£42,112 5 6
Sinking funds	42,609 16 2
Balance (net profit on the year's working)	66,067 11 6
	£150,789 13 2

The balance of net profit is disposed of as follows :—

Amount paid over to the city fund account	£60,000 0 0	
Applied in extension of works where borrowing powers are not granted—		
Carburetted water-gas plant	48 5 7	
Whitworth Street West Depôt	896 17 9	
Chemical works	84 10 8	
Purchase of consolidated 4 per cent. stock for cancellation	3,131 3 10	
Middleton Corporation, in consideration of transfer of Heaton Park gas supply	293 5 0	
Placed to reserve fund account	1,613 8 8	
	£66,067 11 6	

The accounts are followed by the usual appendices, furnishing particulars in regard to the progress of the undertaking.

Appendix A is a comparative statement of the gas transmitted from the works in the daytime and during the twenty-four hours, for the past two years. Summarized, the figures are as follows :—

	Daytime. Cubic Feet.	Twenty-four Hours. Cubic Feet.
Year ended March 31, 1905	1,562,986,000	4,998,456,000
Do. Do. 1904	1,520,618,000	4,994,236,000
Increase	42,368,000	4,220,000

	Cubic Feet.
Gas transmitted from the works	4,998,456,000
Do. accounted for	4,854,235,000
Loss (by condensation and leakage)	144,221,000 or 2·88 per cent.

In Appendix B, particulars are given as to the results of the working from March 31, 1886, to March 31, 1905. The table contains statistics as to the number of tons of coal and cannel carbonized, the total make of gas, the percentage unaccounted for, the yield per ton of coal, the illuminating power of the gas, the quantity of residual products, &c., each year in the above-mentioned period. The particulars for the past financial year are as follows : Coal and cannel carbonized, 456,710 tons ; gas made, 5,008,544,000 cubic feet ; yield per ton of coal carbonized, 10,967 cubic feet ; illuminating power, 17·04 candles ; quantity sold, 4,780,510,000 cubic feet ; quantity sold per ton, 10,467 cubic feet ; percentage of output unaccounted for, 2·88 ; coke for sale, 171,977 tons ; do. per ton of coal, 9·68 cwt. ; make of tar, 24,301 tons ; do. per ton of coal, 11·60 gallons ; ammoniacal liquor (10-oz. strength) made, 10,243,457 gallons ; do. per ton of coal, 28·83 gallons ; sulphate made, 3824 tons ; do. per ton of coal, 24·36 lbs.

Appendix C shows the number of stoves and of each size of meter in use during the year in the city and out-townships. At the close of the past financial year, there were 20,117 stoves on hire within, and 3745 beyond, the city—together, 23,862, compared with 11,399 and 6323 (together, 17,722) at the corresponding date in 1904 ; so that there was an increase of 6140. The number of meters in use was 152,165 in 1905 and 146,457 in 1904. There was last year a net increase of 5708 on the number for the preceding year. The number of prepayment meters in use on March 31 last was 47,865—an increase of 3524 on the number at the close of the preceding year.

From Appendix D, we learn that the gas-mains laid last year within the city extended to 26,358 yards, and beyond the city to 9865 yards—being 20¼ miles 143 yards. The mains taken up were 8447 and 1068 yards respectively—a total of 9515 yards, or 5¼ miles 275 yards. The total net increase during the year, therefore, was 26,708 yards, or 15 miles 308 yards. The total length of mains laid up to March was 1,510,663 yards, or 858¾ miles 143 yards.

Appendix E is an abstract of the capital, revenue, and profit and loss accounts. It shows (*inter alia*) the amount of gross profit made from the gas undertaking, and the mode of its appropriation, also the amount of borrowed money owing, excess of assets, &c., from March 31, 1885, to March 31 last. The figures for the past financial year are as follows : Profit, £153,340 ; paid over for improvement purposes, £60,000 ; applied in extension of works, £4454 ; borrowed money owing, £1,245,815 ; and excess of assets, £1,476,154. The profit is appropriated thus : Interest, £43,459 (including amount charged to sulphate of ammonia) ; liquidation of mortgage debt, £43,813 (do.)—net profit, £66,067. From June 24, 1843, the date when the works were taken over by the Corporation from the Commissioners of Police, the gross profits on the gas undertaking have amounted to £5,450,225, out of which £1,274,023 has been paid for interest, and £1,239,647 placed to the sinking fund ; leaving the net profit £2,936,554. Of this total, £2,360,100 has been handed over to the Improvement Committee and added to the city fund, £329,201 has been paid for street lighting (making £2,689,301 used in relief of the rates), and £100,747 applied in the extension of works for which no borrowing powers have been granted.

BRUSSELS MUNICIPAL GAS SUPPLY.

Report of the Gas Committee for the Past Year.

In the "JOURNAL" for the 11th inst., we gave a few particulars in regard to the supply of gas in Brussels for the twelve months ending Dec. 31, 1904. We have since received the report presented to the Municipal Council by the Gas Committee, and extract from it the following additional information.

The total quantity of gas produced last year was 44,140,550 cubic metres, or about 1558 million cubic feet, against 42,047,270 cubic metres, or 1484¼ million cubic feet, in the preceding twelve months. The entire bulk of gas was disposed of as follows :—

	Cubic Metres.
Lighting	28,758,664
Municipal and other establishments	1,482,300
Gas-engines	4,076,033
Heating purposes	4,229,089
Illuminating devices, balloons, &c.	60,972
Artisans' dwellings and miscellaneous	215,075
Total sold	38,822,133
Public lighting and illuminations	2,867,757
Used on the works, &c.	1,553,369
Unaccounted for	897,291
Total production	44,140,550

The total receipts amounted to 6,813,560 frs. (£272,542), and the expenses to 4,333,773 frs. (£173,351) ; leaving a balance of 2,479,787 frs. (£99,191). Deducting for depreciation in the value of the stores 81,652 frs. (£3266), there was a net balance of 2,398,135 frs. (£95,925), against 2,206,765 frs. (£88,271) in 1903.

The portion of the report dealing with the manufacturing operations shows that 109,454 tons of coal were carbonized, and 4182 tons of oil employed for enrichment, &c., last year, compared with 110,918 tons and 3714 tons respectively in 1903. The quantity of solid material was consequently less by 1464 tons, and of liquid more by 468 tons. The sale of coke was regular during the year ; and at the close there was none in stock. Tar and sulphate of ammonia were well sold ; but the market for cyanides was anything but what could be desired. As usual, a large quantity of the breeze was utilized in the manufacture of compressed fuel, which is employed in heating the retorts. Nearly all the ashes produced on the works were sold for making mortar and repairing the roads. Extensions of works and mains caused an expenditure of 352,420 frs. (£14,097) last year ; increasing to 30,675,985 frs. (£1,227,039), the total capital employed.

During the twelve months covered by the report, 2714 yards of new mains were laid, and 389 services put on. The number of meters in use at the close of the year was 36,859, or 1257 more than at the corresponding period of 1903. There were 126 prepayment meters fixed ; bringing up the total to 4004. The rising mains were increased by 273 ; making the entire number in use 5652. Of interior installations, 319 were fitted up ; so that there are now 14,135 in use in the city. The gas-stoves on hire number 26,567 ; and the gas-engines 411, representing 4183¾-horse power. For public lighting 6746 lanterns, all fitted with incandescent burners, are employed.

Malvern Gas and Electricity Supply.—The Manager of the Malvern gas and electricity undertakings (Mr. W. J. R. Baker) has presented a report on the working for the year 1904-5, showing that the profits on the gas-works have increased from £2552 to £6609. The loss on the electricity works was £1400 for nine months.

Incandescent Gas for School Lighting at West Ham.—As the result of complaints made in regard to the lighting in some of the schools, the Education Committee of the West Ham Corporation had a series of experiments made with the view to effecting improvement. Six different systems of incandescent gas lighting were installed, all of which commended themselves on the score of economy and efficiency ; and three have been selected as being specially suitable. One or other of these is to be installed in the schools from which the complaints emanated ; the five where evening classes are to be established next session to be dealt with first.

PUBLIC LIGHTING IN SHEFFIELD.

In our "Electric Lighting Memoranda" for June 27, comment was made upon a report presented by Mr. S. E. Fedden, the Electrical Engineer to the Sheffield Corporation, on the question of public lighting. Mr. Hanbury Thomas, the General Manager of the Sheffield United Gaslight Company, has sent some edifying remarks on the report to the Chairman and Members of the Corporation Watch Committee; and these remarks, in view of the peculiar cheapness of gas in Sheffield, are of sufficient general interest to be reproduced *in extenso*. They are as follows:—

Sheffield United Gaslight Company, July 17, 1905.

To the Chairman and Members of the Watch Committee of the Sheffield City Council.

Gentlemen,—I have seen a copy of a report made by Mr. Fedden to the Chairman and members of the Electric Light Committee; and as it deals with the question of public lighting, and proposes to substitute electric arc lamps for incandescent gas-lamps, I consider I am justified in making a few remarks in connection therewith.

The suggestion is to substitute, at a cost of £2700 to £3600, 89 arc lamps at £14 per lamp per annum, or a total of £1246 per annum, for 260 four-light incandescent gas-lamps at £3 14s. 3d., or a total of £965 per annum—though in the thoroughfares mentioned to be lit by electricity we can only count 224 gas-lamps.

The number of arc lamps proposed to be erected would be totally inadequate for the work they would have to perform. In Commercial Street there is only one lamp to be fixed between the Birmingham District and Counties Bank Building and the Tramway standard at the junction of Sheaf Street. This is an example, and shows that were the Watch Committee to permit the introduction of the arc lamps, the number would certainly have to be at least doubled.

Some time ago, the Electric Light Department submitted a tender for lighting the Norfolk Market Hall with 24 lamps; but, after the tender was accepted and the lamps fixed, it was found that the number had to be considerably increased; and in the case of street lighting, the argument would be used that "electricity having been once employed, it would never do to have it removed," and there would be no alternative but to incur the additional expense of an increased number of lamps."

Under the heading of "Comparison of Different Illuminants," the following assertions, with reference to incandescent gas lighting, are made:—

> "The bulk of the illumination is not supplied below the horizontal."
>
> "The necessity for frequent changes of mantles; the light falling off very rapidly after the first few hours."
>
> "Unless expensive and elaborate lanterns are provided, the gas-mantles are very susceptible to the wind, which destroys a large number at certain seasons of the year."

The answer to these is:—

(1) That experience has shown that the streets can be, and are, well lit by incandescent gas.

(2) The mantles do not require frequent changes, and the light does not fall off rapidly after the first few hours. We have plenty of tests to prove this.

(3) Expensive and elaborate lanterns are not necessary, and have never been provided in Sheffield. As the result of experience, the lanterns are now made practically wind-tight.

The total cost of a four-burner lamp, as shown above, including mantles and all other charges, is only £3 14s. 3d. per lamp per annum.

I do not think it necessary to deal with the tables showing the amount of electric lighting in other towns, except to point out that the lowest price charged for gas in any of them is at Plymouth, where it is 1s. 9d. per 1000 cubic feet. In Sheffield, the charge is 1s. 2d. per 1000 cubic feet, which destroys all comparison between Sheffield and other cities.

The question of street lighting has occupied a great deal of attention of highly competent authorities, and the conclusion arrived at is that it is altogether a mistake to have lamps of too high a candle power placed far apart. The proper method is to have more frequent points of illumination of a moderate candle power, so that the roadways, &c., may be evenly lit; and this we claim is done very efficiently by the existing incandescent gas-lamps. If more light is required (which is not necessary), it could be economically done by the addition of a few extra burners.

The present day talk among electricians of candle-feet, &c., is only confusing to the ordinary mind. What is required is an illumination that is satisfactory to the eye; and this can only be obtained by a light which is well diffused. The inferiority of electric lighting for streets in foggy weather is well known.

In the City of London, the Court of Common Council have recently discarded a number of electric arc lamps in favour of incandescent gas, both on account of the satisfactory lighting of the latter, and also for economical reasons.

There are many points in the report which I have not considered it necessary to touch upon, but on which I should be pleased to give the Watch Committee information should they require it.

There seems to be a general impression that the ratepayers should be put to additional expense, in order to support the Electric Lighting Department; but I would point out that it is quite as much to the advantage of the ratepayers to encourage the use of gas as of electric lighting. The dividend paid by the Company is a fixed one, and cannot be increased without the consent of Parliament. Therefore, the whole of the profit made on the sale of gas, beyond the sum required to pay the dividend, goes into the pockets of the gas consumers. This is proved by the fact that, during the past four years, reductions have been made to the extent of 8d. per 1000 cubic feet; and as each 1d. per 1000 cubic feet represents £11,310, it follows that the aggregate benefit to the city of such reductions is £90,000 per annum. All new capital is raised in the shape of debenture stock at from 3¼ to 3½ per cent., and is sold by auction. There is really no difference between the Company and the Corporation as regards capital charges. In the one case, they are called dividend; and in the latter, interest. But in both cases capital has to be paid for.

With regard to the employment of labour, proportionately more men are required in the production of gas than of electricity.

It will thus be seen that the ratepayers have an equal interest with the shareholders in the prosperity of the Gas Company.

(Signed) HANBURY THOMAS,
General Manager and Secretary.

GAS v. ELECTRICITY IN LONDON.

Cost of Electric Light in Islington.

The report of Mr. A. Carson Roberts, the District Auditor, on the accounts of the Islington Borough Council for the year ended the 31st of March, has lately been issued; and it reveals an extraordinary state of affairs, so far as the electric light undertaking of the Council is concerned. He points out that since his last audit the cost of providing and maintaining the public lamps has been transferred from the electricity account to the general revenue account, to the latter of which these amounts should, he says, be legally charged. But the rate per unit for the supply of current to the arc lamps, which formerly included the cost of providing and maintaining the lamps, remains unaltered; and the general rate has thus contributed £2600 in excess of the former rate to the electricity revenue account. The Electrical Engineer admits that the rate of charge—viz., 3½d. per unit—requires revision; it being decidedly above the average charge, especially in view of the fact that a majority of the arc lamps are lighted all night. Mr. Roberts says the question is one of more than usual importance in Islington, inasmuch as the system of lighting streets by arc lamps appears to have been applied to a larger extent than in other boroughs; and he observes, from a report of the Finance Committee, dated March 21 last, that sometimes, "where electric arcs take the place of incandescent gas-lamps, the annual cost to the rates is increased in the proportion of about ten to one." The only remark the Finance Committee make upon the foregoing is that "the question raised by the Auditor as regards the electricity undertaking appears to us to be one of policy, and not altogether within his purview."

The Keith System in Paddington.

The Baths and Washhouses Committee reported at the meeting of the Paddington Borough Council on Tuesday having had under consideration various proposals for illuminating the front of the Queen's Road Baths. Schemes for both electric and gas lighting had been submitted; and the Committee considered that the one sent in by the James Keith and Blackman Company, Limited, was the best. The firm were prepared to fit the two existing gas-lamps with high-pressure burners, and to put up two additional hexagonal lamps, one in each corner, to keep the lighting in harmony, and provide the necessary compressor, piping, &c., for £64, less 2½ per cent. discount. The illuminating power provided would be about 3600 candles, with a gas consumption of 120 cubic feet per hour, at a cost of 4d. It was resolved to accept the offer of the Company, on the understanding that if the Council decided within twelve months from the date of the installation to extend the system to the whole of the building, in lieu of the existing electric installation, the cost of the compressor used for lighting the front should be allowed in full upon the substitution of a large compressor for it.

Electric v. High-Pressure Lighting in Kensington.

At the meeting of the Kensington Borough Council on Tuesday, the Works Committee reported that they had had under consideration a proposal by the Gaslight and Coke Company for the lighting of Ladbroke Grove and Portobello Road by high-pressure incandescent gas, together with a report by the Lighting Engineer thereon. According to their proposal, the Company would be prepared to provide the necessary high-pressure main from the compressing plant at their Kensal Green station to the several lamps, and run the compressors during the required hours at the cost of 7s. 6d. per lamp per annum; and they would also supply and fix in each lamp the necessary fittings, &c., and properly connect up each lamp, for the sum of £4 10s. per lamp—the Council to make good all paving, &c., disturbed in laying down the necessary mains. It was estimated by the Company that by the adoption of the system indicated the lighting power of each lamp would be increased fully 300 per cent. The Lighting Engineer, in a report on the matter, confirmed the statement that the illumination of these two streets would be about four times the amount given by the existing lamps; and he estimated that the annual cost of lighting by the suggested system would be about £800, against the present cost of £400. Looking to the increased expenditure which would be incurred if the proposed system were adopted, the Committee recommended that the Company be thanked for their offer, and informed that the Council did not deem it expedient to avail themselves of it. This was agreed to. On the same occasion, the Council accepted an offer of the Kensington and Knightsbridge Electric Lighting Company, Limited, to erect four arc lamps of a new type in Gloucester Place, with the view of showing their power in comparison with the arc lamps now in use, which cost £24 4s. for 3600 hours' burning per annum, against £18 5s. for those proposed to be put on trial. They also referred to the Works Committee a proposal by the Company to carry out side-street lighting with Nernst lamps at 1d. per unit, or £2 15s. per lamp per annum, compared with 2½d. per unit now charged.

Price of Gas for Power at Leicester.—At the meeting of the Leicester Town Council to-day, the Gas and Electric Lighting Committee will recommend a reduction in the price of gas used for power purposes from 2s. to 1s. 6d. per 1000 cubic feet.

BIRMINGHAM GAS ACCOUNTS.

The detailed accounts prepared by Mr. Thomas H. Clare, the City Treasurer of Birmingham (which are referred to in another column), show that the expenditure on revenue account of the gas undertaking for the twelve months to March 31 was £704,401. Of this amount, coal (including oil, carriage, unloading, and all other expenses of depositing same on works) cost £328,320; purifying materials and wages £25,608; salaries of engineers and officers at works, £7487; wages at works, £69,827; repairs, maintenance, and renewal of works, plant, &c. (less old materials sold) £161,327; and repairing property (uninsured), &c., damaged by the explosion at the Saltley works, £4917. Under the heading of distribution, salaries of the chief inspector and inspectors and clerks in light office amounted to £16,989; repairs, maintenance, and renewal of mains and service-pipes, including materials, laying and paving, and labour, to £25,058; and repairing, renewing, and refixing meters, to £5328. Lighting and repairing public lamps cost £3295; rents, rates, and taxes, were £41,008; and the items under management totalled £9077. Under the heading of "Superannuation Scheme, 1897," a sum of £4423 appears; while among the smaller items, bad debts were only responsible for £724. The amount received for gas (less discounts and adjustments) was £669,161; coke and breeze (less labour and cartage), £111,913; tar, £35,406; ammoniacal liquor, £49,781; sundry residual products, £83; rents, £3165; and fittings, £3970. Contributions to the superannuation scheme, 1897, amounted to £1056; and other items brought the total receipts up to £877,241. There was thus, as stated in the Gas Committee's report (see "JOURNAL," May 30, p. 596), a gross balance to carry to profit and loss account of £172,839, of which £50,526 represented the net profit for the year.

TRAMWAYS AND GAS-MAINS AT SOUTH SHIELDS.

Recently a deputation of Directors of the South Shields Gas Company, with the Engineer (Mr. T. H. Duxbury) attended a meeting of the Tramways Committee for the purpose of discussing the probable effects on the Company's mains of the laying of the tramway track at present being carried out. Mr. Duxbury stated that the object of the Company in suggesting the interview was that if possible an amicable arrangement might be arrived at as to the future, whereby the working of the tramways might be interrupted as little as possible from time to time by reason of the Company's operations. He produced plans to show that, with regard to certain portions of the tramway, frequent interruption of the service would take place, and great extra expense would result, if the permanent way were laid on the top of the pipes, as the concrete track would require breaking up and re-instating. The Company's protective powers provided safeguards; but the Directors realized, and they believed the Corporation would also realize, that such extra outlay would benefit neither party. Respecting the electric traction cable, a considerable amount of damage had been caused in other towns through fusion of gas-pipes by reason of their close proximity to the cables; and this was the case with some parts of the South Shields tramways. The Directors had carefully considered the whole question; and they were satisfied that the real solution lay in duplicating the gas-mains, so that they might be placed on both sides of the street, and underneath the footpath or in any other position clear of the cables. The existing distribution system was ample for present requirements, so that any alteration would not yield an increased income to the Company, whereas the cost would have to be defrayed out of revenue. The Company therefore could not bear the cost of the work, which they thought should be defrayed by the Corporation, as they would be saved subsequent expense and interference with the tramways. The cost of duplicating the mains where considered necessary was estimated at £1244. The Committee resolved that the Company be offered £1000 if they would duplicate the mains throughout the tramway routes—this amount to cover all cost to the Corporation in connection with their obligation to the Company.

At the following meeting of the Town Council, Mr. Grant, in moving the adoption of the Tramways Committee's report, which contained this recommendation, said it might seem strange they were offering £1000 for what cost the Sunderland Corporation, who had a much greater mileage of tramways, only £64. But the Company wanted them to do all the work; and to duplicate the gas-mains over the whole of the tramway routes would probably incur an outlay of £5000. They were considering what was best to be done in the interests of the tramways. There were no fewer than 144 service-pipes crossing and re-crossing the streets where they were laying the tramway track on one route; and the tramways would run over the top of them. In another part, the gas-mains ran along the centre of the street, exactly where the tram-lines were being laid. The Company declared that the existing service of mains was sufficient for their purposes; and if the Corporation were causing the necessity for this duplication, they ought to contribute something to the cost. If the scheme was carried out, it would relieve both parties of anxiety as to probable outlay and interruption of traffic in the future, because the old service-pipes would be cut off, and there would be no danger. If nothing was done, then, in the event of anything going wrong, the Company would have to break up the concrete foundations of the tramways; and the traffic in the meantime might have to be entirely suspended. Mr. Gibbon moved, as an amendment, that the matter should go back to the Committee, pointing out that, apart from any arrangement they might be able to effect with the Company in connection with the laying out of new streets, they had nothing before them as to the estimates of cost and the interference to the tramway system that a non-duplicated system would cause. Mr. Marsh, who supported the recommendation of the Committee, said they would probably lose more than the annual cost of the redemption of the £1000 in revenue through the tram-lines being stopped by the opening of the roads, if they did not adopt the arrangement. In his opinion, it was the soundest thousand pounds that they would have invested in the tramway system. In reply to a question as to whether the agreement included the suspended routes, the Town Clerk said it only embraced the system the Council proposed to carry out. Alderman Imrie was in favour of a comprehensive agreement being come to with the Company, so that the whole of their liabilities, both at present and in the future, might be covered. Alderman Rennoldson said no good purpose could be gained by sending the matter back to Committee. It would be good business if they could secure immunity to the traffic from the inconvenience and annoyance attendant upon the opening up of the streets. Mr. Wylie said the laying of the duplicate system would cost a good deal more than the Corporation were offering to pay. If they rid themselves of all liability as was suggested, they would find it the cheaper way in the end. The cost to Sunderland, of £65 up to the present, had undoubtedly been very low; but they must not forget that Sunderland still had their liability. On a vote being taken, the amendment was carried by 18 votes to 11.

QUESTION OF ELECTROLYSIS OF MAINS AT READING.

A Report by Mr. E. M. Lacey.

The Reading Tramways Committee have had under consideration a report upon cases of suspected electrolysis which have occurred in the town, which was prepared by Mr. E. M. Lacey, M.Inst.C.E., M.Inst.E.E., upon the instructions of the Water Committee, after correspondence and consultations with the Town Clerk (Mr. W. S. Clutterbuck), the Water-Works Engineer (Mr. L. C. Walker), the Tramways Engineer (Mr. Walter Binns), and the Engineer of the Electricity Supply Company (Mr. A. T. Cooper).

Mr. Lacey makes the following remarks with regard to three suspected cases of electrolysis last year: (*a*) in Bridge Street, in July; (*b*) at the corner of Broad Street and Queen Victoria Street, in October; and (*c*) at the corner of Western Elms Avenue and Oxford Road, in December. I am of opinion that (*a*) is undoubtedly a case of damage by electrolytic action; but that (*b*) is not a case of electrolytic action, but of direct fusing of the pipe through contact with an electric main. This fusion might have been the result of electrolysis; but such electrolysis or fusion in my opinion undoubtedly arose from an abrasion of the cable by the pipe. I find that the cable belonged to the Electric Lighting Company; but your Water Engineer informed me that the pipe was laid at a subsequent date to that of the laying of the cable. If this is the case the pipe is to blame, since, though the damage was actually caused by the electricity carried by the cable, the evidence goes to prove that the cable must either have been damaged during the laying of the pipe or must have been pressed so tightly by the pipe that the slight movement due to continual expansion and contraction under different conditions of current supply caused sufficient damage to permit of electrolytic action with subsequent fusion. In this instance, therefore, the Electric Light Company's main is in no way to blame, the primary cause of the trouble being the water-pipe. (*c*) This case I do not believe to be one of electrolytic action at all. The appearance of the pipe is unusual and curious; but I am of opinion that it is due to original sponginess of the metal, probably aided by the composition of the soil where the pipe was laid. With the above in view, it is only necessary to deal with the case (*a*), where undoubtedly the cause of the trouble is the electric current either from the Electric Light Company's mains or from the Corporation tramways system. During the course of my investigations, I could find no reason to conclude that any blame attaches to the Electric Lighting Company's system; but while every facility has been given me by the Company for investigating, I must point out that it is almost impossible to trace back over a considerable period a cause from which trouble of this kind might have arisen. There is nothing at the present moment in connection with the Company's system which could cause such trouble, and there is nothing on record which would indicate in the slightest degree that such trouble might have been caused at the date of the breakdown. But it is still within the bounds of possibility that such cause might have existed and has subsequently removed itself or been removed. While the Electric Light Company appear not to have been responsible, there is in my opinion sufficient grounds to suspect the tramway system of being the cause. Mr. Binns kindly supplied us with a sectional drawing showing the position of the different mains in the street at the point where the electrolytic action occurred; and this shows that the electric light cable immediately over the fault was probably the immediate point to which the current was passing. But while this might be the case, the point at which current leaves the water-pipe depends far more on the composition of the soil immediately surrounding the pipe than on the distance from, or position of, any neighbouring conductor. And even if it were granted that the current did flow to the Electric Light Company's mains, it might only have been to the lead sheathing of the main, and such current might quite well have been tramway current. The reason for suspecting the tramway current of being the cause of the disturbance is the fact that in laying down the generating station sufficient precautions were not taken to ensure that the current returned through the rails should be carried back to the generating station, as far as possible from the points at which it would be best to take such returns. . . . While in my opinion the arrangement of return feeders is the cause of the trouble, I would at the same time wish to point out that in tramway installations where two or more return feeders have to be laid down, there is always a great difficulty in apportioning the amounts to be returned by each individual feeder; and while with forethought one is able to reduce to a minimum the possibility of current returning by other than the right feeder, it is never possible to entirely obviate this. Though a considerable number of more unbalanced instances than that of Reading are in existence, the amount of electrolytic damage which has arisen therefrom has been very small. It is necessary that a number of other circumstances favourable to electrolytic action in some particular spot should also be present; and we may conclude that in the instance in your town such conditions were present. . . . In my opinion, the tests taken and observations made clear the Electricity Supply Company from any

suspicion that they have been the cause of electrolytic troubles. They show that such electrolytic troubles have not been caused by faulty bonding or other constructional faults in the tramways system; and if the return feeders are rearranged on a proper basis, I feel certain you have no need to fear any recurrence of such troubles in the future.

In conclusion, Mr. Lacey indicated what alterations to the feeders, &c., he considered should be made, so as to put matters right; and the Committee resolved that the Tramways Manager should be directed to take such steps as he might deem to be necessary for carrying out the suggestions.

EUROPEAN GAS COMPANY, LIMITED.

The Recent Societe Technique Congress at Havre.

The Annual Meeting of this Company was held on Tuesday last, at Finsbury House, Blomfield Street, E.C.—Mr. R. HESKETH JONES in the chair.

The SECRETARY and GENERAL MANAGER (Mr. W. Williams) read the notice convening the meeting, the Directors' report, the statement of accounts, and the Auditors' certificate. The report was as follows:—

Owing to the unsatisfactory state of trade in several towns lit by the Company, the Directors are only able to report a very slight increase of business during the past year. Most of the cotton factories at Bolbec and Rouen have been working short time; and at Havre a severe commercial crisis has prevailed for many months, with the result that there has been a falling-off in the consumption of gas in each of these towns. At Nantes, however, stimulated by the reduced price to which reference was made in the last report, the sales show an increase of 8½ per cent. A substantial improvement has also occurred in the consumption at Amiens and Boulogne. These gains have fully counterbalanced the losses at other stations; and the net result is a slight increase of ¾ per cent. in the gas sold—the advance in rental being ¾ per cent.

Coals have cost practically the same as last year. The revenue from coke and tar shows a slight decline; but the return from sulphate of ammonia has improved.

The profits for the year are sufficient to enable the Board to recommend the payment of the usual dividend of 20s. per share on the fully-paid shares, and 15s. per share on those £7 10s. paid, less the interim dividend of 8s. and 6s. per share respectively paid on the 1st of February last; also that a bonus of 1 per cent. be paid on all shares according to the amount paid thereon, subject, however, to a deduction for French stamp and transfer duty of 1s. 1d. per fully-paid share, and 10d. per share £7 10s. paid in respect of all shares held in France. A balance of £3304 6s. 1d. will remain to be carried to the reserve of undivided profits.

Notice has been given that two Directors (H. E. Jones, Esq., M.Inst.C.E., and E. F. White, Esq.) and both Auditors (J. Reeson, Esq., and A. T. Eastman, Esq.) retire from office at this meeting; but all being eligible, they offer themselves for re-election.

The CHAIRMAN, moving the adoption of the report and accounts, remarked that the former, though very brief, contained the agreeable announcement that the profits of the past year are sufficient, not only to declare the customary 10 per cent. dividend and bonus of 1 per cent., but to add £3000 to the undivided balance carried forward. With reference to the securities which the Company held, these were represented in the books at very much less than the market value. The report commenced with a somewhat pessimistic paragraph announcing that the increased sales of gas did not amount to 1 per cent. on the previous year. This must not be construed into a downgrade movement. The Company's Managers were fully alive to the maintenance and extension of the use of gas; and when he told the shareholders that the number of consumers had been increased by 4½ per cent. during the year—namely, from 64,618 to 67,513—they would realize the truth of this. Personally, he did not always appreciate large increases in business. They necessitated additional outlays and the raising of further capital; and this latter operation was sometimes to the disadvantage of shareholders in Continental undertakings, where the profits had to bear the burden of the necessary amortization to meet expiring concessions—so different from English companies established in perpetuity by Acts of Parliament. Passing from the report and accounts, he would allude to the satisfactory meetings of the Société Technique at Havre last month. The "JOURNAL OF GAS LIGHTING," for June 27, gave a full report of these meetings. The Company's musical *soirée* at the Hôtel Frascati, the welcome they gave at the gas-works to the members, and the excursion they provided for them up the river to Tancarville were noticed; but the private conference of the Board with the Managers was, of course, not reported. The Directors embraced the rare opportunity of having all their Managers in one town to invite them to meet at lunch and exchange views on various matters connected with the Company, having respect to the local circumstances of each town they supplied with gas, and to the general interests of the undertaking. Discussion was carried on with freedom and cordiality; and there was reason to believe that much good would result from—if he might so describe it—this meeting of a happy family of managers of an important industrial undertaking. Last week the Board had a letter from the *doyen* of their Managers, M. Gaston Gautier, expressing the general satisfaction of himself and his *confrères* at the amicable feeling and the *entente cordiale* fostered by the meeting. To commemorate the event, they had had prepared as a post-card a photographic group of the Managers, himself (the Chairman) and Mr. H. E. Jones, and the Secretary and Assistant-Secretary. While at Amiens, an unfortunate incident took place in the shape of the death of one of their Managers—M. Vacher—who had been in the Company's service for 34 years, and was superannuated three years ago. He was very ill at the time of the visit to Amiens; and he (the Chairman) asked Mr. Williams to go and see him. Mr. Williams did so, and just a quarter-of-an-hour after his visit, M. Vacher died. The Company had done what they thought reasonable for the widow; but, of course, the sad event cast somewhat of a shadow over their proceedings at Amiens. Before sitting down, he might be permitted to refer to the satisfactory position of the Company on the Stock Exchange. The last transfer of shares registered in the books gave the selling price as £22 12s. 6d. per £10 share. They were, he believed, in the proud position of being the best dividend paying of Anglo-Continental Gas Companies, with, he thought, the highest invested reserve fund proportionate to the share capital, while commanding almost the highest quotation of any on the Stock Exchange list.

Mr. N. E. B. GAREY seconded the motion, and it was carried unanimously.

On the proposition of the CHAIRMAN, seconded by Mr. E. FELIX WHITE, a dividend was declared of 20s. and a bonus of 2s. on the fully paid up shares, and in proportion on shares only partially called up, according to the amount paid thereon (less the interim dividend), free of income-tax, but subject to a deduction for French stamp and transfer duty of 1s. 1d. per fully paid share and 10d. per £7 10s. paid share, in respect of all shares held in France. Practically, this amounted to a dividend of 10 per cent. and a bonus of 1 per cent.

In moving the re-election of the retiring Directors (Messrs. H. E. Jones and E. Felix White), the CHAIRMAN remarked that the name of White had been familiar to proprietors for a very long time; while as for Mr. Jones, since his accession to the Board he had been of very great assistance to the Company.

Mr. H. D. ELLIS seconded the resolution, which was agreed to.

Mr. JONES, in returning thanks, remarked that the facts disclosed by the Chairman as to the condition of the Company only proved what he himself realized every time he sat at the Board table—that there had been some very wise heads directing the Company for very many years past. He had in his early days a great horror of foreign companies; he thought the price of gas and the capital was too high to permit of success. But he was bound to say that this Company was in his estimation second to none, either on this side of the Channel or the other, in both these respects. As for the works, it had been his pleasure to see them this year with the Chairman, and they were in excellent condition. Most of them possessed an ample margin; and they were constructed on good, sound, simple lines, requiring very little expenditure of capital to keep up, while all worked cheaply, as was shown by the low price of gas and the very satisfactory dividend. He should like to say how gratified he was to be permitted, with the Chairman, to meet all the Company's Managers. He had formed the very highest opinion of their technical officers in France. They were nearly all endowed with some kind of certificate or diploma from a scientific institution—the French, of course, as a rule practised technical education very much more than was the case in England. The officials were most capable and zealous; and further than this, they were most kindly disposed to each other. A Company, wisely represented as they had been by French officers abroad, must always, he thought, be successful, when the quality was like that they had been fortunate enough to secure.

The Auditors (Messrs. J. Reeson and A. T. Eastman) having been re-appointed, on the motion of Mr. R. G. COOPER, seconded by Mr. JOHN SOUTTER,

Mr. R. S. GARDINER proposed a vote of thanks to the Chairman and Directors. He said it was his privilege, a few weeks ago, to visit the works at Havre; and though he knew them by reputation, and knew something of the excellent carbonizing there, he must say that the condition of the works and the first-class results obtained there—the works showing such a judicious standard of expenditure—were extremely gratifying to him as a shareholder. He should like the proprietors to realize that the Chairman and Mr. H. E. Jones had really not done themselves justice in the very short references they had made to the Congress of Gas Engineers at Havre. He could assure them that if they had heard the Chairman express himself in the most excellent French, and in eloquent terms, on several occasions, they would have realized that the Directors were doing their share towards maintaining and developing the understanding between France and Great Britain which was so helpful to the peace of the world and essential to a Company like their own, whose operations were conducted in the neighbouring country. He thought their thanks were very heartily due to the Board of Directors. It would be presumption on his part to endorse what such an authority as Mr. H. E. Jones had said with regard to the Managers; but he had attended many similar gatherings, and had never heard a Mayor speak in words of greater kindliness than did the Mayor of Havre when referring to their Manager there. This was a very important consideration.

Mr. A. W. OKE, in seconding, said he felt sure the Directors were doing all they could to cement that good feeling which should exist between France and Great Britain.

The CHAIRMAN, in reply, remarked that the Board felt greatly indebted to Mr. Gardiner for the kind observations he had made. When they were across last month at Havre it was certainly a very great pleasure indeed, not only to meet their own staff but also the members of the Société Technique, among whom Mr. Gardiner occupied a prominent position. They were received with the utmost cordiality. On the Board they endeavoured to look after the affairs of the Company in the minutest manner; and it was a pleasure and pride to find they had been so successful. He moved a vote of thanks to the staffs in France and London for their efficient services. So much had been said with reference to the officials in France, that he could not add anything. He fully endorsed what had been stated; a more efficient staff he did not think it was possible to have. As for the officers in London, he was frequently with Mr. Williams, who was a most useful General Manager; and he trusted he might live long to occupy this position. The other members in the office were also equally efficient.

Mr. GAREY seconded the vote; and a brief acknowledgment by Mr. WILLIAMS concluded the proceedings.

Carlisle Town Council and the Geltsdale Water Scheme.—At their last meeting, the Carlisle Town Council again had before them the question of proceeding with the building of a storage reservoir at Castlecarrock, in connection with the Geltsdale water scheme. When first the matter came before the Council a month ago, it was adjourned for a month, to permit of further investigation into the advisability of providing this reservoir, which was estimated to cost £75,000. It has now been agreed that the reservoir is the *crux* of the whole scheme, and it was decided to advertise for tenders. One member remarked that the more he saw of the Gelt, the more he was impressed with the good quality of the water.

CONSOLIDATION OF BOSTON GAS COMPANIES.

A correspondent recently sent to the "American Gaslight Journal" some particulars regarding the consolidation of the Boston Gas Companies—an operation which was carried out at the National Shawmut Bank on the 15th ult. The Boston, Brookline, Jamaica Plain, South Boston, Dorchester, Roxbury, Bay State, and Massachusetts Pipe-Line Companies had met and decided to sell their properties to the Boston Consolidated Gas Company; the latter had agreed to buy; and the consolidation has now been accomplished beyond the possibility of recall or interference. The following table gives the number of shares in the different Companies who voted in favour of selling to the Consolidated:—

Dorchester Gaslight Company	5,185
South Boston Gaslight Company	4,383
Roxbury Gaslight Company	5,993
Massachusetts Pipe-Line Company	10,000
Jamaica Plain Gas Company	2,441
Boston Gaslight Company	4,994
Brookline Gaslight Company	19,998
Bay State Gas Company of Massachusetts	19,993

The terms on which the eight Companies sold their entire properties as going concerns are not to be made public. The properties stand in the inventory for something like $24,000,000, as was determined at the time of the inquiry by the Gas and Electric Light Commissioners under the Consolidation Act of 1904. But as the minority interests are so small, the promoters are virtually in the dual position of buyer and seller, and the actual prices paid do not much matter. All the stock of the Massachusetts Pipe-Line Company is in the treasury of the Massachusetts Gas Companies, and all but some 70 shares of the other seven Companies are also the property of those Companies, who will hold in their treasury all the stock of the Boston Consolidated Company, using the income to pay dividends on their own stock. If the Consolidated Company should earn 8 per cent., as is thought likely, the proceeds will suffice to pay 4 per cent. on the $25,000,000 of Massachusetts gas preferred stock, and leave enough to pay 1 per cent. on the $25,000,000 of ordinary stock irrespective of any earnings from the Association's other important property, the New England Gas and Coke Company.

Our contemporary's correspondent makes the following remarks on the important event above noticed: "Although the inwardness of the local gas consolidation has been thoroughly discussed during the last six months, its accomplishment may be briefly reviewed as to its effects. The eight Companies named are consolidated under cap. 417 of the Acts of 1904, as amended by the Legislature of 1905, in the matter of the capitalization to be allowed the new Company. As soon as the minority stockholders are paid the value of their holdings, the existence of the Companies named will terminate, and the gas business in the local field will be done by a single Company. The Consolidated Company is capitalized by $15,124,600; being the sum of the stocks, bonds, and certificates of indebtedness of the merging Companies. The sum was fixed by the General Court of 1905, after much opposition had developed to the original plan of capitalization on an asset basis—which would have given the new Company about $20,000,000 capital. The merging Companies are required to pay their bonds and certificates of indebtedness, and all other liabilities are assumed by the Consolidated Company. A condition of the consolidation is that the new Company shall furnish gas at 90 c. per 1000 cubic feet within a year. In carrying out the plans set on foot, there have been filed with the Commissioners certificates of the various Companies, stating that by a vote of more than two-thirds of the stockholders these Companies have agreed to transfer their property, rights, and franchises to the Consolidated Company. As a step towards cheaper gas, the Consolidated Company have petitioned the Commissioners for the approval of a contract with the New England Gas and Coke Company, providing for the sale to it by the latter Company, until Dec. 1, 1907, at 14 c. per 1000 cubic feet, of unpurified gas of 12-candle power. The former contract, made in 1897, was for a term of 50 years, and the price was 15 c. This contract the Consolidated Company wish to abrogate."

Those of our readers who have followed American gas questions, and more especially those connected with Boston, will naturally look for the name of Addicks in connection with the scheme just completed. The correspondent who furnished the foregoing particulars shall give an account of him and his doings. He says: "The only ripple on the surface of a deal involving more than $15,000,000 was the appearance on the scene of the redoubtable J. Edward Addicks, once the Napoleon of Boston gas, but to-day merely a minority stockholder in some of the Corporations involved. Mr. Addicks's reappearance in the local gas situation was short, dramatic, ineffective. He protested, voted his stock against the deal, and threatened to get out an injunction to stop its consummation. This threat did not materialize, however, though Mr. Addicks departed before the final scene in the transaction had been enacted. Those who recall Mr. Addick's entry into the Boston gas field some years ago could not but contrast its *éclat* with his somewhat inglorious exit. Then he was buying Boston gas stocks at fabulous prices. To-day he departed, still the owner of some shares—said to be not more than five in any one of the Companies interested—but about to be shorn of even these by the processes of the law. Like the other minority shareholders, he will be informed as to the amount of money due to him under the terms of the sales. If satisfied with the amount, he will receive it in cash; if not, he has, under law, recourse to the Massachusetts Courts, who will appraise the value of his shares, which he is bound to accept. Of all the shares in the eight Companies, not more than 70, including those of Mr. Addicks, are held outside the Massachusetts Gas Companies, the promoters of the deal."

A serious breakdown has taken place at the Leyland Water-Works, near Preston, which has practically cut off the water supply for some period. The dry weather has caused all the wells to be exhausted; and now, for the first time in Leyland, a water famine has set in.

METROPOLITAN WATER BOARD.

The Ordinary Meeting of the Board was held on Friday last—Sir R. M. BEACHCROFT in the chair.

The Finance Committee submitted the estimates for the financial year ending March 31, 1906. They showed that on the revenue account the total net income during the year, after deducting allowances and losses on collection of water-rental, was estimated at £2,758,500, the total expenditure at £2,722,335, and the estimated surplus at £36,165. The total net estimated income from all sources was £2,758,500, as compared with the actual net income for 1903-4 of £2,669,302; showing an increase during the two years of £89,198. The total gross estimated water-rental income for the year 1905-6 was £2,774,210, against the actual gross income for 1903-4 of £2,681,847; being an increase of £92,363, or an average over two years of £46,181. The average increase for the five years was £67,383; but this included the abnormal increase for the quinquennial year 1901-2. Exclusive of that year, the average increase for the four years would be £61,315. Comparing the increase of £49,365 for 1903-4 with this average, the reduction was no less than 19·49 per cent. The gross increase shown by the estimates for 1905-6 was only £46,181; and the further drop was due to the partial cessation of building in certain districts and other causes. The total estimated expenditure on the capital account in the year 1905-6 amounted to £675,718; while the income was estimated at £34,951. The estimates were approved.

On the recommendation of the Water Examination Committee, Dr. A. C. Houston was appointed Director of Water Examinations, at a salary of £1000 per annum. The Committee presented a report containing a communication from Sir William Crookes and Sir James Dewar, who stated that it appeared to them that this appointment must inevitably interfere with their present office and functions, and therefore they had decided to ask the Board to relieve them of their duties, and allow them to retire gracefully from the responsible positions they had so long occupied. The Committee observed that, having regard to the appointment of the Director of Water Examinations and to the views expressed by Sir William Crookes and Sir James Dewar, they had come to the conclusion that it would probably be more convenient and agreeable if the office they held were abolished. They recommended accordingly, and this was agreed to.

A report by the Works and Stores Committee contained reference to the increased filtration area in the southern district. They stated that the Board had recently had before them a report on the question of the short supply of water in certain portions of the Lambeth section of the southern district, in which it was stated that the trouble was caused by the choking of the filters; there being insufficient filtration area for the needs of the district. Though there was no doubt that the works which were now practically completed, and which were undertaken by the Board with a view to linking up the Southwark and Vauxhall and Lambeth areas, would lessen the risk of the trouble recurring in the future, they were advised that, as a further precaution, and in order to deal with the increasing demands, extra filtration area to the extent of about 12 acres of filter-beds should be constructed. The Chief Engineer (Mr. W. B. Bryan, M.Inst.C.E.) recommended that about 6 acres should be constructed on land at Hampton already in the possession of the Board, and that, in order that they might be completed in time for next summer, they should be commenced at once and pushed forward with all possible speed. He would report at a later date with regard to the remainder of the land; and as soon as the Committee received his advice they would report to the Board.

THE LANGSETT WATER SUPPLY OF SHEFFIELD.

The Financial Situation.

At the Meeting of the Sheffield City Council last week, Alderman Gainsford, the Chairman of the Water Committee, made reference to the Langsett water scheme. He said it might strike some people as strange that Langsett water had not been used before now, considering the extraordinary drought, and also that there should be any question as to obtaining special permission to do so. But the Committee had thought that the financial obligations which went along with the bringing of the Langsett works into actual use were of so much importance that it would be better to bring the matter before the Council. As soon as the works come into use, there would be a charge upon the revenues of the Water Department variously estimated at from £24,000 to £30,000 a year. It was not right that things of this sort, or even of a similar character, should take place merely on the authority of a Committee, and that the Council should simply find that the thing had been done. The resolution of the Committee was to the effect that the Council authorized the Committee to bring the works into use as soon as it was necessary to do so. The financial obligations were only those which were necessarily incident to the construction of very large works. They were the charges for which the large surplus fund had been built up. As soon as the Langsett water was brought into use, they would cease to purchase water from the millowners; and he thought the Council would agree with him that they should use the works for the purpose for which they were constructed, and the reserve fund for the purpose for which it was built up, rather than go on purchasing from the millowners an immunity from the penalties which would fall upon the Corporation if they did not send down the full amount of compensation water. It had been legally correct that interest upon cost of construction should be charged to capital account during the course of construction; and this amounted to £90,170. But it was quite another thing to continue charging interest upon cost of construction when the works were really finished and might be brought into use. The legality of it was very doubtful indeed. He thought it very likely that their partners at Rotherham would dissent from what he had been advocating. They might have their own financial reasons for postponing the evil day and continue piling up interest on the capital account as long as they

possibly could. Doncaster, the other partners, did not wish anything of the kind. He was bound to say that they would be glad to meet Rotherham's wishes as far as they could; but they had to consider the interests of the great city of Sheffield first. If Rotherham had not built up a reserve fund during the last six or seven years in order to meet circumstances which they must have foreseen—if they had chosen rather to keep the money in their pockets—they could not blame anybody for what had come to pass. Unless a downpour of rain came, they would have to begin using the water in a very few days. With reference to the charges made for water, he thought there would be a surplus before many years, which might be used for the advantage of the city; and whatever surplus there might be beyond £150,000 was bound automatically to be applied in reduction of the water charges, without any discrimination whatever. Inasmuch as the water charges were already as low as in any town in the country, it was not advisable that they should be further reduced. What he would like to see done would be the rounding off of the powers of the Committee by obtaining three things. In the first place, the Council should have the power to discriminate in the way of charges, so that they should not be tied hand and foot. He would like to see power also to use any surplus for the general benefit of all the city. To this latter point, however, there was one reservation. The Council must be true to their undertaking and parliamentary obligations made when the transfer took place. It was then stipulated that £50,000—subsequently raised to £150,000—should be accumulated as a reserve fund, and that any surplus should go to the reduction of charges, and not into the funds of the Corporation. The sole idea of the authors of the Act was to avoid rates-in-aid. It was thought at the time that the works would be a losing concern; and it was sought to preserve the consumers from increased charges. Nothing of the sort had occurred. There had been no provision made for a real surplus, and nothing but a surplus had arisen. They were, therefore, right in saying that they wanted powers to meet that which had arisen, and which had not been contemplated. These powers would be contingent, however, on a large reserve being kept in hand. What he would recommend was that, as soon as public opinion was sufficiently formed for the purpose—he would like to see it done next year—powers should be sought that, whenever there was at least £120,000 in hand, then all surplus beyond this should be absolutely at the disposal of the Corporation, and that they should have power to utilize it with absolute discrimination. Why he did not propose that the money should go in any particular direction was that there were so many opinions that it would be better to put it into the discretion of the Council if they could get the power.

Alderman Clegg remarked that the Committee were to be congratulated on keeping their surplus in hand. Manchester had been in a hurry to reduce their charges, and were faced with a heavy deficit. He was satisfied that the course the Water Committee were taking was a wise one.

The Committee's minutes were adopted.

Gas Poisoning Case at Huddersfield.—A man named Field, who lived alone at Huddersfield, and who for some weeks past had been medically attended for fits, was last Wednesday morning found lying on his bed with the gas-tap in the room turned on. He was immediately removed; but unfortunately the efforts made to save his life were unsuccessful.

BATH WATER-WORKS ARBITRATION.

Surveyors' Institution, June 22 and July 3.

(Mr. DANIEL WATNEY, *Umpire*.)

This was an arbitration respecting a claim for compensation brought by Mr. A. W. Hick against the Corporation of Bath, arising out of the compulsory acquisition of water rights under the Bath Water-Works Act, 1903.

Mr. FOOTE, K.C., and Mr. GREGORY appeared for the claimant; Mr. WAUGH, K.C., and Mr. SIMON represented the Corporation.

Mr. GREGORY, in opening, explained that the arbitration was to assess the amount payable in respect to certain matters which were originally set out and contained in a notice to treat of March 22, 1904, but which, he thought, were now confined, speaking generally, to the matters detailed in an agreement which had been arrived at between the parties, dated May 13, last. Under the Bath Corporation Water Act of 1903, the Corporation obtained power to go to certain places outside the city in order to obtain and convey into the city water from certain springs there; and among these places was the estate belonging to the claimant at Bath Easton. He understood that the Corporation had completed the works which they were authorized to undertake upon the land in question—they had tapped the water and carried it away into their main system. The Corporation under the powers contained in their Act, more particularly section 8, instead of acquiring "any lands for the purpose of any works," had inserted their pipes and sought to acquire "permanent easements in respect thereof." Under these particular powers, they now sought to pay compensation for easements and not for the land. They had taken and made use of certain parts of the land under the surface; but they had left to the claimant (for what it was worth) the use of the surface. With regard to the claimant's position, he was the owner in fee-simple of properties in Bath Easton, and they were known as Wayfield, Church Farm, Upper and Lower Stokes' Close, and a messuage known as Fern Cottage. In addition to this there was another piece of ground of which he was the owner in fee-simple, known as Crocksham. These properties were collectively of the value of £12,750. Bath Easton itself had a population of 1648, and was connected with the city by a system of electric trams, which it was believed was likely to materially affect the value of land for building purposes in the neighbourhood. Upon Church Farm there were some valuable springs of water. It was in respect of the water from these springs that the first item of the claim arose. In addition, the Corporation had, under the powers contained in their Act, laid down conduit pipes that passed through the land, and to which they had right of access in perpetuity; they had also placed upon them five manholes to which also they had right of access. This, of course, seriously interfered with the user in the future. In addition to the rights under the Act, the parties had met in May this year and entered into an agreement which gave the city more extended rights and reduced very much the benefit in the land to the owner. After quoting from the agreement, Counsel mentioned the form in which the claim was made. There was a claim with regard to the easement for the pipes, and also one with regard to another easement for the collecting and carrying away of water. There was a further claim with regard to the work done in respect to surface damage. Then compensation would be claimed for the value of the water taken; and there was a further item in consequence of the agreement of May,

GAS COMPANIES' STOCK AND SHARE LIST.

Referred to on p. 229.

Issue.	Share.	When ex Dividend.	Dividend or Dividend & Bonus.	NAME.	Closing Prices.	Rise or Fall in Wk.	Yield upon Investment.
£			p.c.				£ s. d.
590,000	10	Apl. 13	10½	Alliance & Dublin 10 p.c.	20⅞—21⅛	..	4 17 8
160,000	10	,,	7½	Do. 7 p.c.	14⅞—15⅛	..	4 16 9
200,000	5	May 12	6½	Bombay, Ltd.. . . .	6½—7	..	4 12 10
140,000	5	,,	6½	Do. New, £4 paid	5—5⅛	..	4 14 6
50,000	10	Mch. 15	14	Bourne- mouth Gas and Water 10 p.c. . . B 7 p.c. . Pref. 6 p.c.	29½—30½	..	4 11 10
251,810	10	,,	7		16½—17½	..	4 0 0
53,200	10	,,	6		15½—16½	..	3 12 9
380,000	Stk.	Feb. 24	12	Brentford Consolidated	248 - 253	..	4 14 10
300,000	,,	,,	9	Do. New . . .	188—193	..	4 13 3
50,000	,,	,,	5	Do. 5 p.c. Pref. .	127—132	..	3 15 9
206,250	,,	June 15	4	Do. 4 p.c. Deb. .	103—106	..	3 15 6
220,000	Stk.	Mch. 15	11	Brighton & Hove Orig.	225—230	..	4 15 8
246,320	,,	,,	8	Do. A. Ord. Stk. .	165—170	..	4 14 2
460,000	20	Mch. 30	10	British	40—41	..	4 17 7
100,000	Stk.	Feb. 24	6	Bromley, Ord. 5 p.c. .	120—125	..	4 16 0
165,700	,,	,,	4½	Do. do. 3½ p.c. .	90—94	..	4 15 9
500,000	10	May 12	7	Buenos Ayres (New) Ltd.	11⅛—12	..	5 16 8
250,000	Stk.	June 29	4	Do. 4 p.c. Deb. .	95—97	..	4 2 6
150,000	20	July 13	8½	Cagliari, Ltd.	24—26*	..	6 6 11
100,000	10	May 31	10	Cape Town & Dis., Ltd.	17—17½	..	5 14 3
100,000	10	Apl. 28	4½	Do. 4½ p.c Pref.. .	10—10½	..	4 5 9
50,000	50	May 2	6	Do. 6 p.c. 1st Mort.	52—54	..	5 11 1
50,000	Stk.	June 29	4½	Do. 4½ p.c. Deb. Stk.	100—102	..	4 8 3
1,400,000	Stk.	Feb. 24	5⅛	Commercial 4 p.c Stk. .	116—119	..	4 7 4
560,000	,,	,,	5	Do. 3½ p.c. do. .	112—115	..	4 6 11
450,000	,,	June 15	3	Do. 3 p.c. Deb. Stk.	85—87	..	3 9 0
800,000	Stk.	,,	6	Continental Union, Ltd.	105—110	..	5 9 1
200,000	,,	,,	7	Do. 7 p c Pref.	137—142	..	4 18 7
424,070	Stk.	Feb. 18	5½	Derby Con. Stk. . . .	124—126	..	4 7 4
55,000	,,	June 3	4	Do. Deb. Stk. . . .	108—110	..	3 12 9
486,090	10	Jan. 27	11	European, Ltd. . . .	22—23	..	4 15 8
354,060	10	,,	11	Do. £7 10s. paid	15—16	..	5 3 2
15,243,200	Stk.	Feb. 10	4⅛	Gas- light and Coke 4 p.c. Ord. . . 3½ p.c. max. . . 4 p.c. Con. Pref. 3 p.c. Con. Deb.	99—100	..	4 8 0
2,600,000	,,	,,	3½		92—94	..	3 14 6
3,799,735	,,	,,	4		109—111	..	3 12 1
4,193 975	,,	June 15	3		88—90	..	3 6 8
258,740	Stk.	Mch. 15	5	Hastings & St. L. 3½ p.c.	100—103	..	4 17 1
70,000	10	Apl. 28	11	Hongkong & China, Ltd.	18—19	+½	5 15 9
3,800,000	Stk.	May 12	10	Imperial Continental .	211—214	+1	4 13 6
473,600	Stk.	Feb. 10	3½	Do. 3½ p.c. Deb. Red.	96—98	..	3 11 5
175,242	Stk.	Mch. 15	6	Lea Bridge Ord. 5 p.c. .	120—125	..	4 16 0
561,000	Stk.	Feb. 24	10	Liverpool United A . .	224—226	..	4 8 6
718,100	,,	,,	7	Do. do. B .	166—168	..	4 3 4
306,083	Stk.	June 29	4	L'rpool Unit'd Deb. Stk.	111—113	..	3 10 10
75,000	5	,,	5	Malta & Medn., Ltd. .	4—4½	..	5 11 1
560,000	100	Apl. 1	5	Met. of 5 p.c. Deb..	102—104	..	4 16 2
250,000	100	,,	4½	Melbourne 4½ p.c. Deb.	102—104	..	4 6 7
541,920	20	May 31	3½	Monte Video, Ltd. . .	11—12	..	5 16 8
1,565,892	Stk.	Feb. 24	4½	Newc'tle & G'tesh'd Con.	108—109	..	4 4 10
406,625	Stk.	June 29	3½	Do. 3½ p.c. Deb.	92—93	..	3 15 3
15,000	10	Feb. 24	10	North Middlesex 10 p.c.	19—20	..	5 0 0
52,940	1/	,,	7	Do. 7 p.c.	13—14	..	5 0 0
300,000	Stk.	May 12	8	Oriental, Ltd. . . .	145—148	..	5 8 1
600,000	5	Mch. 30	7	Ottoman, Ltd. . .	6—6½	..	5 12 0
168,255	Stk.	—	6½	Plym'th & St'house 5 p.c.	—	..	—
398,490	5	Apl. 28	6	Primitiva Ord. . . .	5⅛—6	..	5 0 0
796,980	5	Jan. 27	5	Do. 5 p.c. Pref. .	5¼—5½	+⅛	4 10 11
488,900	100	June 1	4	Do. 4 p.c. Deb. .	95—97	..	4 2 6
851,070	10	Apl. 28	7	River Plate Ord. . . .	12—12⅛	+⅛	5 12 0
300,000	Stk.	June 29	4	Do. 4 p.c. Deb. .	95—97	..	4 2 6
250,000	10	Apl. 13	7	San Paulo, Ltd. . . .	12⅞—13⅛	..	5 5 8
70,000	50	July 1	5	Do. 5 p.c. Deb. .	51—53	..	4 14 4
135,000	Stk.	Mar. 15	10	Sheffield A	236—238	..	4 4 0
209,984	,,	,,	10	Do. B	236—238	..	4 4 0
523,498	,,	,,	10	Do. C	236—238	..	4 4 0
123,998	Stk.	Mch. 30	5	Shrewsbury Ord. 5 p.c.	107—110	..	4 10 11
70,000	10	May 31	10	South African	15⅝—16⅛	..	6 1 3
6,250,000	Stk.	Feb. 10	5½	South Met., 4 p.c. Ord.	130—132	+2	4 3 4
1,832,700	,,	July 13	3	Do. 3 p.c. Deb.	89—91*	..	3 5 11
575,000	Stk.	Feb. 24	5½	S'th Suburb'n Ord. 5 p.c.	121—124	..	4 8 9
60,000	,,	,,	5	Do. 5 p.c. Pref. . .	125—130	..	3 16 11
112,533	,,	July 13	5	Do. 5 p.c. Deb. Stk.	127—132*	..	3 15 9
502,310	Stk.	May 12	5	Southampton Ord. . .	107—110	..	4 10 11
87,950	,,	—	4	Do. 4 p.c. Deb.	—	..	—
120,000	Stk.	Feb. 24	6½	Tottenham A 5 p.c. .	125—128	..	4 17 8
338,020	,,	,,	4½	and B 3½ p.c. .	98—101	..	4 14 1
125,000	,,	June 29	4	Edmonton 4 p.c. Deb.	105—108	..	3 14 1
182,380	10	June 15	8	Tuscan, Ltd.	9½— 0	..	8 0 0
149,900	10	July 1	5	Do. 5 p.c. Deb. Red.	100—102	..	4 18 0
30,000	Stk.	Feb. 24	7½	Wands- worth and A 5 p.c. . . B 3½ p.c. . . C 3½ p.c. . .	163—168	..	4 12 3
255,636	,,	,,	6½		135—140	..	4 9 3
60,000	,,	,,	5⅛		114—116	..	4 13 6
57,564	,,	June 29	3	Putney 3 p.c. Deb. Stk.	80—85	..	3 10 7
745,872	,,	Mch. 15	5	West Ham 5 p.c. Ord.	102—104	..	4 16 2
185,000	,,	,,	5	Do. 5 p.c. Pref. .	123—126	..	3 19 4
103.300	,,	June 29	4	Do. 4 p.c. Deb. Stk.	104—109	..	3 13 5

Prices marked * are "Ex div"

for the depreciation in value to the owner of the surface of the land, through his covenant not to do anything to interfere particularly with the quality of the water of the springs. There was also the question of the loss to Mr. Hick of the value of the surface of this property owing to the covenant he had entered into.

Mr. *John Gerrish* said that after the Contractors to the Corporation had completed their work, he made a valuation for: (1) Damage to growing crops, &c., on land in hand; and (2) value in perpetuity of the easement for the pipes carried through the estate. He put the damage to the crops, garden of Fern Cottage, &c., at £130 16s., including £25 16s. in respect of barley and crops, and £100 for damage to garden, annoyance, &c. Altogether passing over the estate there were 125 yards of 18-inch and 620 yards of 6-inch pipes. He put the value of the easement in respect of these, including interference with water rights, at £402. This was at £8 per perch.

Mr. *F. W. Gardiner* put in plans showing that, in his opinion, on the western portion of the property at Bath Easton 23 houses of the annual value of £50 could be built, and on other portions 23 houses of from £25 to £30 annual value, and 22 cottages of from £10 to £12 annual value. He considered these respectively would be worth ground rents of £6, £3, and £1 10s. In consequence of the agreement with the Corporation, however, in respect of the land through which the pipes passed, the land could not now be used for building purposes owing to the danger of pollution. Apart from the engineering question with regard to the water supply scheme, he regarded the site as a good one for a building estate.

Mr. *H. Sheppard*, the Engineer and Surveyor to the Bath Rural District Council, said he had seen the proposed plans for the building estate; and he saw no reason whatever why they should not be carried out. The roads shown were of the proper width and construction in accordance with the bye-laws. With regard to the gradients, gradients of this character were usual in the neighbourhood of Bath.

In cross-examination, witness said the road indicated on the plan was only 16 feet wide; but he did not consider in the laying out of the estate that this would have to be made 36 feet wide.

Further evidence was given, as to the value of the property for building purposes, by Mr. *G. N. Sturges* and Mr. *J. W. Hooper*, both of whom contended there was a demand for houses at Bath Easton.

Mr. *G. Orrell-Jones* said he had, for the purposes of the arbitration, formed an estimate of the loss to Mr. Hick by the taking away of his springs, on the basis of the profit he would lose by being prevented from supplying his building estate with water. He had assumed that there would be 33 houses, two farms, Wayfield House, and Fern Cottage, which, at a water-rate of £4 each, produced £154 per annum. From this he deducted £5 for vacant houses and 20 per cent. for working expenses; leaving £119 net annual income. This he capitalized on the 3 per cent. basis, giving £3973. From this he deducted £820 for reservoirs, leaving £3153. This he deferred for ten years, which gave £2346, which he considered was the amount that should be paid the claimant as compensation in respect of water rights.

On the resumption of the proceedings early this month,

Mr. *E. Brough Taylor* said he had valued the springs on the property of Mr. Hick. He took the average flow at 45,000 gallons, and put 1d. on every 1000 gallons, equalling £68 8s. 9d. per annum. This he capitalized, and multiplied by 33½ years' purchase, £2281 5s. He put on 10 per cent. for compulsory sale, £228 2s. 6d., making the value of the springs £2509 7s. 6d. He made the annual value of the water-rates £159 10s. His total valuation, including 10 per cent. for compulsory sale, was £2673.

Mr. *J. H. Oakley* said he had considered the compensation payable in respect of the easement, manholes, and disturbance during the carrying out of the work. His total for the easement and disturbance was £302. With regard to the 26 acres affected by the agreement, the land would be depreciated in value by £50 an acre. This gave a total of £1345 for the land, which, added to the amount of the easement, made his total £1647. To this would have to be added the value to the claimant of the water rights.

This concluded the case for the claimant.

Mr. WAUGH, in opening for the Corporation, contended that it was a mistake to say that Bath Easton was not within the limits of compulsory supply of the Bath Corporation, as was also the argument that the taking away of the water might leave the claimant without a source of supply when his estate was developed for building. Residents of Bath Easton would be able to be supplied on exactly the same terms as citizens of Bath. The Corporation had to supply not merely for ordinary domestic purposes, but should have an adequate supply in case of fire. The whole of the claimant's suggested scheme for supplying water from the springs was based on the assumption that Mr. Hick could impound the whole of this water, and that the millowners down the stream which derived its supply from there would have no rights of action to prevent him. The springs could not be impounded except by excavating; and the millowners deriving power from the stream would have grounds for seeking to prevent this. The millowners themselves had in fact got the right of compensation against the Corporation for taking the water; and he asked whether they were to pay compensation twice—by paying Mr. Hick for the full rights, and then by paying the millowners. His witnesses would contend that the gross income that could be derived from the water was about £80; and in order to get this gross income there would be an initial expense of £1000. It might be fifteen years before the estate was developed to repay the income estimated; and he contended that no one would go to such an outlay and wait any such time for this return, and the risk of litigation with the millowners. In addition, the road giving frontages to the estate could not be made at anything like the price suggested. The claimant's witnesses estimated the cost at £1900; but his witnesses would say that it would really cost something like two or three times as much as that; and in consequence of the steep slope of the land it would not be built upon at all. For the easement and disturbance his witnesses put the compensation payable at £275; but the 26 acres they contended would never be used for

CARBURETTED WATER-GAS APPARATUS

Merrifield—Westcott—Pearson Patents.

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	Cub. Ft. Daily.		Cub. Ft. Daily.		Cub. Ft. Daily
BLACKBURN	1,250,000	ST. CATHERINES (Remodelled)	250,000	TONBRIDGE	300,000
WINDSOR ST. WORKS, BIRMINGHAM	2,000,000	KINGSTON, PA.	125,000	STRETFORD	500,000
SALTLEY WORKS, BIRMINGHAM	2,000,000	PETERBOROUGH, ONT.	250,000	OLDBURY	300,000
COLCHESTER	300,000	WILKESBARRE, PA.	750,000	TODMORDEN	500,000
BIRKENHEAD	2,250,000	ST. CATHERINES (2nd Cont.)	250,000	SALTLEY, BIRMINGHAM (Third Contract)	2,000,000
SWINDON (New Swindon Gas Co.)	120,000	BUFFALO, N.Y.	2,000,000	YORK (Second Contract)	750,000
SALTLEY, BIRMINGHAM (Second Contract)	2,000,000	WINNIPEG, MAN.	500,000	ROCHESTER (Second Contract)	500,000
WINDSOR ST., BIRMINGHAM (Second Contract)	2,000,000	COLCHESTER (Second Contract)	300,000	NEWPORT (MON.)	250,000
HALIFAX	1,000,000	YORK	750,000	TOKIO, JAPAN	1,000,000
TORONTO	250,000	ROCHESTER	500,000	PERNAMBUCO (Brazil)	125,000
OTTAWA	250,000	KINGSTON, ONT.	300,000	MALTON	150,000
LINDSAY (Remodelled)	125,000	CRYSTAL PALACE DISTRICT	2,000,000	DULUTH, MINN. (2nd Cont.)	300,000
MONTREAL	500,000	CATERHAM	150,000	BROCKVILLE (ONT.)	250,000
TORONTO (Second Contract Remodelled)	2,000,000	LEICESTER	2,000,000	SMETHWICK	500,000
BELLEVILLE	250,000	ENSCHEDE (HOLLAND)	150,000	GRAVESEND	300,000
OTTAWA (Second Contract)	250,000	BUENOS AYRES (RIVER PLATE CO.)	700,000	NEWPORT MON. (Second Contract)	250,000
BRANTFORD (Remodelled)	200,000	BURNLEY	1,500,000	TORONTO (Third Contract)	750,000
		KINGSTON-ON-THAMES	1,750,000	TORONTO (Fourth Contract)	1,000,000
		ACCRINGTON	500,000	MONTREAL, ONT. (2nd Cont.	1,800,000
				HAMILTON, ONT.	400,000

LEEDS, 1,800,000 C. Ft. LEICESTER (2nd Cont.), 1,000,000 C. Ft. NEWCASTLE-ON-TYNE, 1,800,000 C. Ft.

AND IN ADDITION, 7,900,000 CUBIC FEET DAILY; also Coal-Gas Plants at NELSON, B.C, CHATHAM, BERLIN, NAPANEE, OWEN SOUND, CALGARY, and WINNIPEG.

anything but agricultural purposes and could not be dealt with as building land.

Evidence in support of Counsel's statement was given by Mr. *William Fox*, Mr. *E. A. Rawlence*, and Mr. *J. E. Henshaw*, the Chairman of the Water-Works Committee of the Bath Corporation.

The proceedings were further adjourned.

YORKSHIRE AND THE DROUGHT.

The prolonged drought is having serious results in many of the smaller towns and villages in Yorkshire, though the larger centres of population are yet fairly well supplied. At Leeds, there is still four months' water in the reservoirs; but the Corporation have resolved to stop the use of hose-pipes unless rain falls within a reasonable period. The position at Bradford is fairly satisfactory; there being more water in store than was the case last November, though the amount is considerably less than it was this time last year. The Halifax reservoirs are running low; the total quantity of water available, with careful usage, being estimated as sufficient for nine or ten weeks. It is stated that there is at present no need for alarm at Huddersfield; and no restriction in the supply has been considered needful, beyond the request that consumers should cease the use of hose-pipes. The amount of water in store at Sheffield is not much more than half what it was at the corresponding period of last year; and, as is reported elsewhere, the advisability of drawing upon the Langsett reservoirs is being considered. Thanks to the recently carried out Midhope water scheme, Barnsley is fairly secure; while at Harrogate there is stated to be no immediate cause for anxiety, and the same holds good at Thirsk. The Tees Valley Water Board are also in a position to supply their district without restriction. Doncaster hopes to tide over the drought; while Grimsby is reported to be quite safe; and at Hull there is at present no intention whatever of curtailing the supply. Bridlington and Scarborough have also amply sufficient water for all requirements. The drought still continues in the East Cleveland district; and the root crops have suffered very much. The haymaking season is almost finished; and the crops are far from satisfactory. In the Skelton, Brotton, and Upleatham districts there is a great scarcity of water, both for domestic purposes and for cattle. There is a danger of some of the local works lying idle if there is not shortly a downfall of rain. All the springs and becks are completely dry. The rainfall for the past three months has been the lowest recorded for many years; and such a long spell of drought is not remembered by the oldest inhabitants. There is a great scarcity of water at Howden at the best of times; and the present drought has materially lessened the supply. There is a well in the town which is capable of yielding 6000 gallons per day; but the inhabitants require for their needs fully twice this quantity. In the Holderness district the want of water is being severely felt. Some of the farms in Sunk Island are experiencing a shortness of supply, and have to cart the water for miles for domestic purposes and for cattle.

PROTECTION OF FACTORIES FROM FIRE.

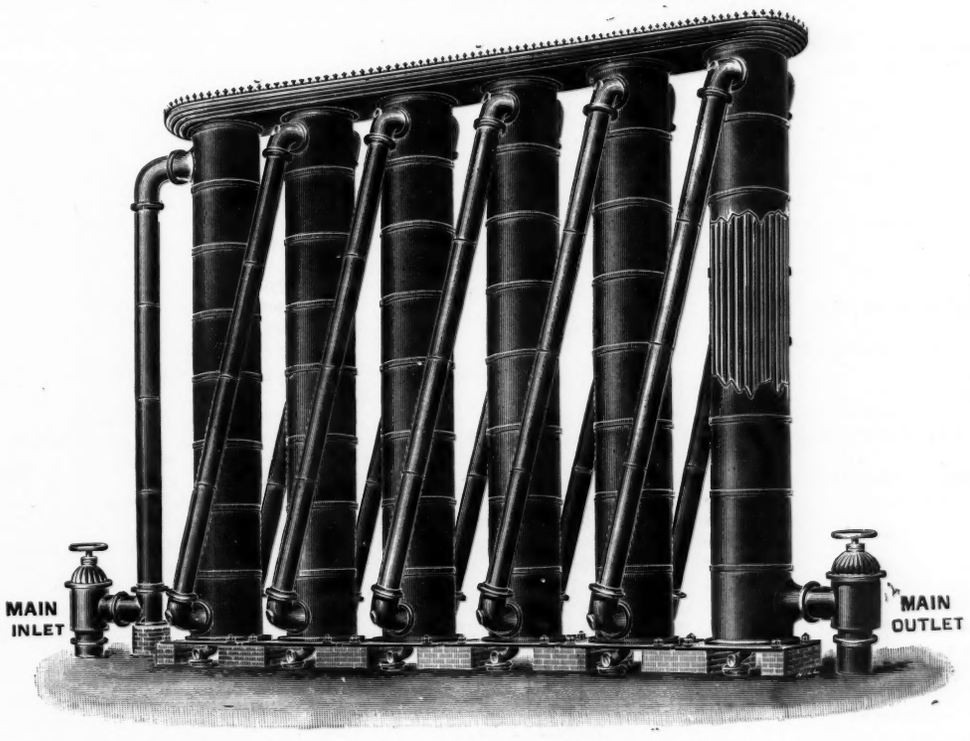
Liability for the Cost.

Some years ago, the owners of cotton and woollen mills in New England decided, in order to lessen their annual insurance premiums, to pool their expenses and their fire experience, with a view to carrying their own insurance. The outcome of this decision, according to "Engineering Record," was the successful organization known as the New England Factory Mutuals, whose efforts produced a system of fixing insurance rates which, in its essential features, has since served as a model for the regular stock companies doing insurance business in all parts of the country. The controlling principle in insurance rating is that the rate should be proportionate to the fire hazard. A factory which has a complete fire protection equipment is less hazardous, and can be insured at a lower rate, than one whose fire protection is not up to the standard. This means that the owner of a factory equipped with fire-protection service supplied from city water-mains derives an actual cash benefit of so many dollars per annum in the reduction of his premium in consideration of this fire-protection connection. If the factory should burn down, the owner would be subjected, in addition to the actual property loss, which would be covered to a large extent by insurance, to loss of business while the plant was idle; and against this loss, often very serious, his only insurance would be the manner in which the plant was built, equipped, and operated with a view to protection against fire. Here again he would derive an actual benefit from the fire-protection connection with the city mains—a benefit which, while it cannot be actually measured in money, might readily be considerably larger than the actual cash reduction in annual premiums.

While it is true that in lessening his individual fire hazard the owner would also lessen to some slight extent the conflagration hazard of the community in which his factory is located, this benefit to the community is very slight as compared to the amount by which he profits individually by his fire-protection connection. The openings in his fire service-pipes are on his premises, and many of them are inside his buildings. They are not readily accessible for use in protecting the property of others, and it must not be forgotten that, should the factory owner be dishonest enough to do so, his large fire pipe puts it within his power to draw, without detection, great quantities of water from the mains; or his pipes might leak or be broken, with similar results. In this sense he constitutes, in the aggregate, a menace to the water supply of his community, which is probably at least commensurate with the reduction, in the aggregate, of the general conflagration hazard by reason of his fire-protection equipment. Setting off the one against the other, the owner of a factory equipped with a fire-protection system supplied by a special connection to the city mains may fairly be considered to be the sole and exclusive beneficiary of such connection. In order to be in a position to supply water for fire protection, the local water department or water company must be put to expense.

CONDENSERS.

WATER COOLING.



ATMOSPHERIC.

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In a paper read before the American Society of Civil Engineers in April, 1897, Mr. Emil Kuichling estimated that fully one-third of the annual charge on the cost of construction of the average plant was due to provision for fire protection. He also estimated that about one-fifth of the working expenses was chargeable to provision for fire service and for future growth—the latter being about one-half of the former; so that, according to him, about 33 per cent. of the fixed charges due to construction, and 14 per cent. of the operating expenses, were chargeable to provision for fire protection. Another authority—Mr. J. T. Fanning—in a paper read before the American Water-Works Association in May, 1896, estimated that about two-thirds of the construction cost of the average plant, and about one-third of its operating and maintenance expenses, were chargeable to the provision made for fire protection. Averaging these two estimates, it will be seen that about 50 per cent. of the annual fixed charges due to construction cost, and 20 per cent. of the annual operating and maintenance expenses, are chargeable to the fire-protection item.

The total receipts of the water department or water company should be sufficient to pay, first a reasonable interest on the investment; secondly, the annual contribution to the sinking fund to repay the amount invested within a reasonable time; thirdly, the annual contribution for depreciation; and, lastly, the annual working expenses, including repairs and minor improvements. These total receipts should be divided, as equitably as possible, between the charges for the domestic and those for the fire-protection service.

Fire-protection service may be either public or private. Under the former would be included that provided by the fire-hydrants in the public streets. The special facilities afforded to individual establishments, such as the factory previously alluded to, may be classed as private fire protection. Our contemporary from whom we have quoted thinks it only fair that public fire protection should be paid for by general taxation, in the case of private ownership of works, in the form of hydrant rentals; and in the case of municipal ownership, by an equivalent annual payment from the general fund into the fund provided for water-works. The factory owner and others, who, like him, may be considered the sole and exclusive beneficiaries of private fire protection, should each pay his quota of the amount of the total receipts properly chargeable to this item.

INDIRECT DAMAGES FROM RESERVOIR CONSTRUCTION.

A short time ago our contemporary "Engineering Record" called attention to the fact that the indirect damages which can be claimed, even under the most favourable legislation, are very small in cases arising from the appropriation of water and the construction of reservoirs. It appears that the Massachusetts Supreme Judicial Court have lately laid down a very clear ruling on this subject. The Legislature, by a series of Acts, undertook to deal most liberally with parties injured by the construction of the Wachusett reservoir of the Metropolitan Water-Works. Ordinarily, the damage done to a person's business is not a matter for which he is entitled to compensation; but in this case, in addition to providing compensation for real estate taken, and that not taken but depreciated in value, the Legislature provided that, in certain cases, individuals and firms should be compensated. The plaintiff in this case had a 50-acre farm, from which he supplied hay, vegetables, eggs, milk, and cider in the neighbouring village. He had no regular customers for any of these things. The village was destroyed by the construction of the reservoir, and plaintiff's action was to recover the damages thereby caused to his business. The point was raised by the defendants' lawyers that as the plaintiff had no regular customers he could not have an established business in a legal sense. The Court decided that farming was a business, and that the plaintiff was legitimately engaged in it, and had been so for at least fifteen years, which was sufficient proof that it had no element of uncertainty in it. Had the purchasers of the products gone to the farm to obtain them, there would probably have been no question about the established character of the business; and the Court ruled that the manner in which the surplus products were actually sold should not be considered an argument against assigning it this character. The Court pointed out clearly that the Legislature did not intend that everyone injured in business or occupation should be compensated for it. Such an attempt would be impracticable, but the best possible relief was afforded. By the building of the reservoir, certain towns and villages would be altogether destroyed and their inhabitants dispersed. Naturally there would be cases in which individuals derived support for themselves and their families, in whole or in part, from supplying the wants of these inhabitants. Any such business would be largely or wholly destroyed; and the Legislature took means to relieve such damages in case the business was established, like that of plaintiff in this instance. Our contemporary calls attention to this case because it sets forth very clearly the Massachusetts view of the subject. The State has made greater provision for such indirect damages than has ever before been put on American statute-books; and it is interesting to observe that in this case the damages assessed by the Commissioners for the purpose, and approved by the Court, were only $150 and costs.

Suffocation by Gas.—A sad affair, which has caused considerable sensation in Lichfield, was discovered last Saturday morning. Lieut.-Col. Oswald Barton Feilden and his wife, who returned from their holidays at Hastings on Friday night, retired to bed shortly before ten o'clock. Next morning the housemaid went to call them, but received no answer. Her suspicions were aroused by hearing someone breathing heavily, and going into the room she found the Colonel dead on the bed, and his wife unconscious on the floor. There was a strong smell of gas; and, on examination, it was found that the jet near the fireplace was full on. It was presumed that the Colonel put down a portmanteau by the side of the jet, which was formerly connected with the gas-stove, and thus accidentally turned on the tap.

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NOTES FROM SCOTLAND.

From Our Own Correspondent.

Saturday.

"A pleasant talk and a pleasant walk" fitly characterizes the meeting of the North British Association of Gas Managers at St. Andrews this week. It was not a meeting at which anything was done that will be looked back upon as of outstanding merit. Rather it was a hewing of wood and drawing of water—a working meeting, in which the members applied themselves to the daily round, the humble task, with diligence from start to finish. There were forebodings that the meeting would suffer in attendance by reason of the place where it was held being difficult of access, and probably still more difficult to get away from. This feeling prevailed down to the last moment. I myself travelled by the train arriving at St. Andrews immediatety before the meeting was opened; and I was the solitary passenger who was bound for the gathering. A number had arrived at St. Andrews the previous evening; the others came later. Even after I arrived, the President —Mr. J. W. Carmichael, of Barrhead—had his doubts as to the attendance. It was therefore with a feeling of relief that it was seen that the hall filled up so well that by midday the number present did not fall short of that which has been the average of recent years. Mr. Hall's connection with gas making began a long time ago. He is an architect by profession; and it was a somewhat singular coincidence that the beautiful hall of the United College, in which the meeting was held, was the building which, sixty years ago, he went to St. Andrews to superintend the erection of. He has been fifty-five years Manager of the St. Andrews Gas Company, though now, in his declining years, he is associated with his son—Mr. Robert Hall—as Joint Manager. It will be gratifying information to many that Mr. Hall is still hale and hearty. As will be seen from the report of the proceedings, he was able to take part more than once in the work of the meeting. Twenty-seven years ago, when the Association last met in St. Andrews, he was President. It was another coincidence of the meeting this week that twenty-seven years ago Mr. Hall had under him, as a youth learning his profession, Mr. J. W. Carmichael, who, on the return of the Association to St. Andrews, was its President. From this happy set of circumstances, it is not surprising that a pleasant meeting resulted. Mr. Yuill's paper was the weightiest of the three that were read. It is one which few can criticize, because the subject is one that is not much looked into by Gas Managers. The other two were both on subjects of interest, were well handled, and evoked good discussions. The Association, it will be noted, repeated its resolution not to affiliate with the Institution of Gas Engineers. It seems to be the opinion that the situation was not bettered, but the contrary, by the last overture that was made to them by the Institution in the sense that, by the very name, the North British Association would have been branded as a District Association, whereas it is a National Association. The position of the Scotsmen is redolent of national pride—a quality which is not to be condemned anywhere. Had they been approached in a different way, probably that feeling would not have crept into the proceedings. When another try is made, it may be successful in winning over the men of the North British Association. But it is evident that it will not be upon the terms offered; and it need not be made till after the lapse of some years.

Than Mr. W. R. Herring's report to the Edinburgh and Leith Gas Commissioners, given in another column, it would be difficult to conceive a more convincing document in favour of the reduction of the illuminating power of the gas supplied by the Commissioners. The division of the subject into the six headings he adopted so simplifies the questions to be considered, that it is easy to grasp the whole situation; but when, in addition, each division is filled up with convincing reasons for making the change, any Commissioner who may venture to oppose his proposal—if there should be any, which I do not expect—must be in a doubting frame of mind indeed, and may be held to be immune from the effects of reasoning. It will be observed that the report is not loaded with statistics as to outputs or yields. The only figures given are those with reference to the composition of the two gases—those supplied in London and in Edinburgh. These are made to prove that from the chemical point of view—which in this question is the bed-rock point of view—the change would be advantageous. Mr. Herring might have gone further, and pointed out that in these northern latitudes it is necessary to have a more permanent gas than it is where the climate is more stable. While I think there is little doubt but that the Commissioners will be convinced by Mr. Herring's report, it would be rash to say that they will adopt it. Public opinion has to be reckoned with; and it is easy to understand that the Commissioners may not have the courage of their convictions. We know, from experience, how touchy the people of Edinburgh are in the matter of gas supply. In anticipation of the existence of some such feeling, it would probably be the wisest policy, before putting the subject to a vote in the Commission, to have another report from Mr. Herring, dealing with the probable effect of the change on the various classes of consumers. In this way the Commissioners would be furnished with material upon which they could reason with anyone upon the subject, and be able to give unanswerable reasons for making the change.

In the Kilmarnock Town Council last week, Mr. Climie asked whether the Gas Committee had considered the advisability of introducing gas-stoves, as was being done in other towns. He thought it would be to the interest of the town to issue stoves free, as they would get a much larger consumption of gas. Bailie A. Robertson, the Convener of the Gas Committee, said they were anxious to utilize their gas plant as much as possible, and they considered the question of stoves, but they thought that to give them without payment, or in any other way than on the hire system, would lead to a great amount of trouble.

Mr. A. Mackay, late of Glasgow, has not been long in Montrose; but the effect of his management upon the affairs of the Montrose Gaslight Company is already apparent, and it is, on all points, to the benefit of the Company. At the annual general meeting last Wednesday—Mr. A. Muirden, the Chairman of the Directors, presiding—

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Mr. Mackay's report was read. In it he stated that during the year the quantity of gas manufactured amounted to 29,308,000 cubic feet—an increase over the previous year of 1,200,000 cubic feet. The coal carbonized amounted to 2798 tons. Unaccounted-for gas had been reduced by 2 per cent. The number of ordinary meters in use had been increased by 100, and of prepayment meters by 300. In their report, the Directors recommended payment of a dividend at the rate of 37s. 6d. per share, as compared with 35s. a year ago. This left a sum of £233 to be carried forward, as compared with £145. It was indicated that there was a prospective reduction in the price of gas to ordinary consumers of 2d. per 1000 cubic feet for the current year. Mr. Thomson moved that it be an instruction to the Board of Directors that, at their first meeting, they consider the matter of increasing Mr. Mackay's salary. Mr. Aitken seconded, and the motions were adopted unanimously.

For the year ending May 31 last, the Saltcoats Gas Company had a balance at credit of profit and loss account, after providing for depreciation on works, of £1380. Out of this sum the shareholders agreed, at their annual meeting, to pay a dividend at the rate of 7½ per cent., absorbing £1200, and carried the balance of £180 forward. The price of gas was continued at 3s. 4d. per 1000 cubic feet. The revenue from gas was £3953. Residual products realized £640. This was a considerable decrease, owing to the low market prices of tar, liquor, and coke. The total revenue was £4708. Gas unaccounted-for amounted to 5 per cent. During the year, the number of consumers increased by 63.

The Selkirk Gas Company last year had a make of 33,140,000 cubic feet—an increase of 3,670,000 feet over the preceding year. The quantity of coal used was 3243 tons, from which there was a yield of 10,218 cubic feet per ton. The profit for the year was £945. A dividend of 10 per cent. on the original share capital has been paid, and, in addition, £250 has been added to the depreciation account, and £242 to the surplus account.

At the annual meeting of the Annan Gas Company, it was reported that the revenue for the year had been £798—an increase of £208. The dividend for the year is at the rate of 6 per cent., free of income-tax, which is 1 per cent. higher than for the previous year, and a sum of £128 is carried forward. The price of gas was reduced, on Oct. 1 last, from 3s. 6d. to 3s. 4d. per 1000 cubic feet; and it has been resolved to still further lower it to 3s. 2d. With a view to encouraging the sale of gas for manufacturing purposes, users of gas-engines have been granted a discount of 10 per cent. from Jan. 1 last; and considerable reductions have been made in the rents charged for cooking-stoves. The quantity of gas made during the year was 14,826,400 cubic feet—an increase of 489,200 cubic feet upon the previous year.

The Castle-Douglas Gas Company have paid a dividend of 7 per cent. for the past year, with a bonus of 2 per cent., and have reduced the price of gas from 4s. 7d. to 4s. 4½d. per 1000 cubic feet. The Stow Gaslight Company have paid a dividend of 5 per cent., free of income-tax. The Newburgh (Fife) Gaslight Company have reduced the price of gas by 10d. per 1000 cubic feet. The Haddington Gas Company have reduced their price by 5d. per 1000 cubic feet—the prices now being 3s. 9d. for ordinary lighting, and 3s. 6d. for cooking and motive power. The Ferry-Port-on-Craig Gaslight Company had an income of £1238, an expenditure of £1071, and a profit of £167 last year. They have paid a dividend at the rate of 5 per cent.

The Corporation of North Berwick are the first which I have heard of to adopt a system of public lighting to be turned on and off automatically. The installation is being fitted up in the High Street by Messrs. Alder and Mackay, of Edinburgh.

The Dunbar Corporation Gas Department, out of the profits earned last year, paid £127 towards the cost of erecting a new house for the Gas Manager, and placed £90 to the stove account.

CURRENT SALES OF GAS PRODUCTS.

Week ending July 22.

In London pitch, further large business has been done with the Continent, which again shows that the firm attitude of the makers with respect to prices is justified. The market for 90 per cent. benzol remains strong at 9½d. net. Carbolic acid, 60's, however, is scarcely so steady as recently, partly in consequence of reported cheap selling on the west coast. Ordinary London creosote is much inquired for; but holders are firm at 1⅜d. net. Sulphate of ammonia is still a rather disappointing article, and it is doubtful whether more than £12 8s. 9d. net, on Beckton terms, can now be obtained for early delivery.

Sulphate of Ammonia. LIVERPOOL, *July* 22.

There has again been a quiet market, urgent requirements being limited; but as available supplies have also been in small compass, prices have been about maintained. The closing quotations are £12 6s. 3d. per ton f.o.b. Hull, and £12 7s. 6d. to £12 8s. 9d. per ton f.o.b. Leith and Liverpool. In the forward position there has been good inquiry; but the efforts of buyers have been directed to bringing about a still lower level of prices, and not much first-hand business has resulted. The views of makers are about £12 10s. per ton f.o.b. for July-December delivery, while buyers are unwilling to go beyond £12 5s.

Nitrate of Soda.

This article is again easier; the closing spot prices being 10s. and 10s. 3d. per cwt. for ordinary and refined qualities respectively.

Tar Products. LONDON, *July* 22.

Business has been rather quiet during the past week, although as a rule prices have been fairly well maintained. In benzol, some 90 per cent. has been sold for prompt, and further business is reported

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at 9½d. London for August shipment. In the North, business has again been done at 9d. for August-September; but as regards forward delivery makers decline to sell at present. In 50-90 per cent., sales have been made to English consumers at the equivalent of 8½d. for August-September; and there is still a good demand at this price. There are now buyers of toluol at 8¼d. to 8½d. f.o.b. London; but makers have nothing to offer at present for early delivery and as a rule quote 9d. forward. The position of solvent naphtha is unchanged. There is really no business of any importance to report, although there is a fairly good inquiry for forward delivery from the Continent. Refiners here, however, will not sell forward except at improved prices, which at present consumers decline to pay. There is really nothing fresh to advise in anthracene. Carbolic acid is decidedly quiet. Continental consumers appear to be very easy as regards the position of this article. There are still buyers at 1s. 9d. for 60's for August-October; but makers as a rule ask 1s. 10d. to 1s. 10½d. forward. In crystals, there is no business of importance to report. Several small parcels of 39-40 per cent. have been sold at 6¼d. for early shipment. There is a fairly good business doing in creosote in the Yorkshire district at prices varying from 1¾d. to 1⅞d.; while $1\frac{7}{16}$d. was paid in one instance for special quality. The largest London makers are still very firm in their ideas; but there is a certain quantity of salty oil offering from the smaller distillers which could no doubt be purchased at about 1¼d. There is no business of importance to report in the Liverpool and Manchester district, where markets are decidedly quiet just at present. In pitch, there is really nothing fresh to report; and briquette makers do not appear to take much interest in the article at the moment. So far as South Wales is concerned, consumers only offer prices which are considerably under makers ideas, and business therefore does not result, although undoubtedly some of the largest consumers would purchase over the first six months of next year if manufacturers showed any desire to reduce their prices. There is nothing of importance to advise on the east coast, and prices are fairly steady; but no business is reported for either prompt or forward delivery. The Belgium consumers appear well supplied for early delivery; and so far as forward is concerned, they do not seem particularly anxious to purchase, except at prices which both dealers and makers decline to entertain. In the Lancashire district, there is still a certain quantity offering for early delivery; but the weather continues too hot to entertain any question of early shipment.

The average values during the week were: Tar, 16s. to 21s. 6d. Pitch, London, 28s. 6d. to 29s.; east coast, 28s. to 28s. 6d.; west coast, 26s. 6d. to 27s. 6d. **Benzol, 90 per cent.**, 9½d.; **50-90 per cent.**, 8½d. **Toluol**, 8¼d. **Crude naphtha**, 3¼d.; **solvent naphtha**, 8¼d. to 8½d.; **heavy naphtha**, 10d. to 11d. **Creosote, London**, $1\frac{9}{16}$d. to $1\frac{11}{16}$d.; North, 1¾d. to 1⅞d. **Heavy oils**, 2d. to $2\frac{1}{16}$d. **Carbolic acid, 60 per cent.**, 1s. 9d. **Refined naphthalene**, £4 to £8; **salts**, 12s. 6d. to 14s. **Anthracene**, "A" quality, 1½d. to 1⅝d.; "B" quality, unsaleable.

Sulphate of Ammonia.

The market is decidedly quiet, and there is very little business doing. Beckton still quote £12 10s. to £12 12s. 6d., according to position. In Hull, there are sellers at £12 7s. 6d. for prompt; but buyers will not at present pay more than £12 5s. to £12 6s. 3d. for early shipment. Business at Leith is reported at £12 7s. 6d. for prompt delivery by dealers; but makers are said to be asking rather over this figure. The market in Liverpool is quiet, and there are sellers at £12 7s. 6d. for prompt delivery.

COAL TRADE REPORTS.

Lancashire Coal Trade.

The Lancashire coal trade is going through a period of dulness and inactivity which it has not experienced for a long time past. The Coal Exchange at Manchester is very thinly attended. Little business is passing. House coal is not wanted; and although the cotton trade is flourishing, and engine coal is in fair request, less fuel is needed to make steam than when the temperature is less than tropical. While cotton operatives are agitating for an increase of 5 per cent. in wages, colliers are suffering from short time and diminished remuneration, of which there is no remedy yet in sight. It will be September or October before any real improvement can be expected. Prices show no variation from last week.

Northern Coal Trade.

There is a rather better demand for some kinds of coal; but, as usual at this time of the year, some of the collieries have occasionally to be idle for lack of full work. In the steam coal trade, the demand is steady; but exports to the Baltic lack the full proportions sometimes known this month. Best Northumbrian steams are from 9s. 4½d. to 9s. 6d. per ton f.o.b., second-class steams are 8s. 3d. to 8s. 6d., and steam smalls are firm at from 4s. 9d. to 5s. 6d. In the gas coal trade, the demand is a little fuller, and the deliveries will be larger in a week or two. Prices of fair Durham gas coals are, according to kind, from about 7s. 9d. to 8s. 3d. per ton f.o.b. The contract has been settled for some 20,000 tons of Durham gas coals for Leghorn; and after making allowance for freight, &c., it is supposed that the rate left for the coal will be close upon 8s. per ton f.o.b. Coke is steady; and gas coke maintains its value for shipment, though it is easier at some of the inland works.

Scotch Coal Trade.

The Glasgow Exchange was on holiday last week, so there is no report as to trade, nor quotations. The shipments reported for the week were 247,528 tons—a decrease of 16,983 tons upon the previous week, and of 9109 tons upon the corresponding week of last year. For the year to date, the total shipments have been 6,408,675 tons—an increase of 362,939 tons upon the same period of 1904.

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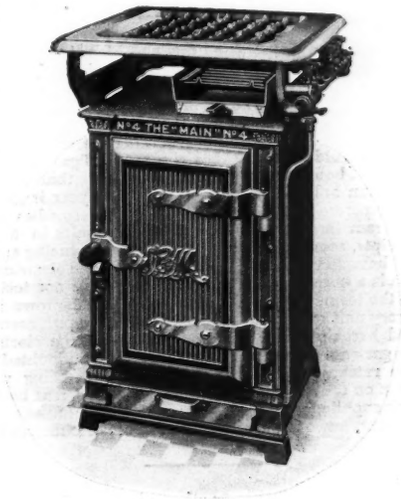
Cooker



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The Public Lighting of Malton.—The Malton Urban District Council, having invited tenders for the lighting of the streets on the expiration of the existing contract with the Gas Company, resolved that the more important streets should be illuminated by 54 electric lamps, and the remainder by 124 gas-lamps. Mr. Henry Tobey, the Engineer of the Gas Company, who it will be remembered was recently elected Chairman of the Council, wrote complaining that after four applications he had been unable to get from the Surveyor the details he wanted as to the position and number of the lamps; and as he could not obtain these particulars, his Company would not accept any apportionment of lamps the Surveyor might be inclined to allow them, and so withdrew their tender.

Plymouth Water Supply.—An inquiry was held at Plymouth last week by Colonel A. J. Hopper, on behalf the Local Government Board, respecting an application by the Town Council for power to borrow £12,000 for water-works purposes. The Town Clerk (Mr. J. H. Ellis) explained that the money was required for the extension and renewal of mains. Some of those which were laid many years ago had become almost choked, and needed renewal. There were no outstanding loans in connection with these mains. The extensions were rendered necessary by the development of the town. The Water Engineer (Mr. F. Howarth) and the Chairman of the Water Committee (Mr. Debnam) gave evidence; the former stating that it was proposed to provide out of the loan measuring apparatus at the storage reservoir at Burrator.

Important Water Scheme for Cumberland.—At the meeting of the Whitehaven Rural District Council last Thursday, the Clerk submitted a report embodying a proposed scheme of water supply from the Gosforth Springs for serving six parishes in the southern district at an estimated cost of £14,117. The population numbered 3200, and allowing for a supply of 15 gallons per head per day, the estimated consumption was 51,000 gallons. The scheme would involve a rate-in-aid of about 1s. in the pound. The Committee also recommended that the Egremont Urban District Council should be informed of the adoption of this scheme, and of the abandonment of one previously proposed, which contemplated taking in the Egremont District Councils' area. The report was adopted, and a copy was ordered to be sent to the Local Government Board.

The Competition of Corporation Gas and Electricity Departments.—As an example of the way in which ratepayers suffer by the supply of electricity being pushed at the expense of the gas undertaking, to which reference was recently made in the "JOURNAL," we quote the following from an Ilkeston paper of last Saturday: "The Tramways and Electricity Department continues working under the most appalling financial difficulties. Now that the actual figures for the year ending March last have been arrived at, it is found that the losses are even heavier than anticipated; and the current year is going worse than ever. Desperate diseases call for desperate remedies, and if the alteration in tram fares produces but small results in the way of increased receipts, some more drastic methods of reducing expenditure will probably have to be taken. On the side of the electric light and power, too, it is a question whether the charges are not too low to be profitable to the town. Indeed, it is asserted that the town is actually a loser by every unit of electricity it sells for power purposes. This is a doubly bad bargain when it is considered that the electric motor displaces the gas-engine, and that the latter is an undoubted source of profit to the ratepayers." The electric light is being pushed by advertisements on the backs of the tram tickets; current being offered at 3d. per unit supplied through penny and shilling in the slot meters. Up to the present, however, we believe none of these meters have been applied for.

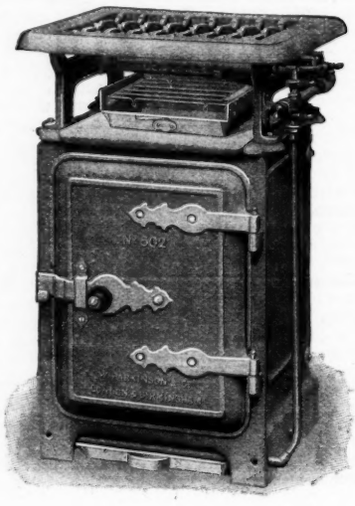
The Maidstone Gas Company, through their Engineer (Mr. H. Smythe), have given instructions to the Richmond Gas Stove and Meter Company, Limited, to fit up complete installations consisting of a meter, cooker, pendant, and brackets (providing material, labour, &c.), in houses in their new district of Hollingbourne.

A Company under the title of the Cregagh Extension Water Scheme, Limited, has been registered with a capital of £400, in £10 shares, for the purpose of laying a water-main from the city boundary of Belfast, on the Cregagh Road, and, after connecting it with the main of the Belfast Water Commissioners, running it along the road to the houses situated in the Cregagh district.

Last Saturday week, the South Wales Municipal Engineers visited the Cray water-works as guests of the Swansea Corporation. They went up by special train, accompanied by the Mayor (Mr. Alderman Spring) and several members of the Council, and were piloted by Mr. R. H. Wyrill, M.Inst.C.E., the Borough Engineer. At Cray they were met by the Mayor of Brecon (Mr. Rich), and Mr. B. M'Kenzie, the Manager of the Works Construction. The visitors were shown over the works, and greatly admired the manner in which the undertaking is being carried out. Reference was made to the low comparative cost, considering the results obtained. During the afternoon Mr. Wyrill read a paper in which he described the various Swansea water undertakings. He was highly complimented by the visitors on his paper and his design.

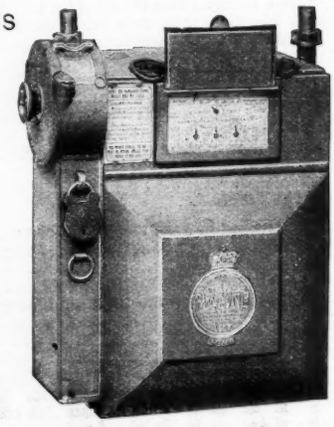
On Saturday, the 15th inst., the Mayor of Southport (Mr. E. Trounson, J.P.), who was for some years Chairman of the Gas Committee, paid a visit to the gas-works at Crowlands, accompanied by members of the Corporation, among whom were the Chairman of the Gas Committee (Alderman G. F. Travis), the Gas Engineer (Mr. John Bond), &c. The production of gas, the utilization of residuals, and the testing process were minutely described; a large number of invited guests being extremely pleased with the explanations. The automatic stokers were at work, and the operations were seen to advantage. In the course of some complimentary speeches, Alderman Travis referred to the methods adopted by the Gas Committee, and to the efforts made by them to save expense; and he paid a high compliment to the work of Mr. Bond.

PARKINSON'S



SLOT INSTALLATIONS

FOR QUOTATIONS



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The Queenstown Gas Company have erected an aërial ropeway to connect the jetty where the colliers unload with the coal-store at the works. The ropeway is 795 feet long, and between the terminals it is supported on three triangular trestles placed at equal distances apart. The coal is carried in specially constructed buckets at the rate of 20 tons per hour; and the cost is said to be ½d. per ton from the ship's side to the store. A 5-horse power gas-engine supplies the power. The installation was supplied by the Ropeway Syndicate, of London.

WANTED, FOR SALE, CONTRACT, &c. ADVERTISEMENTS IN THIS WEEK'S "JOURNAL."

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MANAGER. Millom Gas and Water Department. Applications by Aug. 1.
REPRESENTATIVE (GAS COAL TRADE). No. 4432.
SUPERINTENDENT GAS FITTINGS DEPARTMENT. No. 4438.
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Exhibition. Application for space to Newcastle-on-Tyne Gas Company.

Company Meetings.

BRENTFORD GAS COMPANY. Charing Cross Hotel. Aug. 4. 2 30 o'clock.
GASLIGHT AND COKE COMPANY. Offices. Aug. 4. Twelve o'clock.

Company Meetings—(*Continued.*)

HORNSEY GAS COMPANY. Offices. Aug. 4. 3.30 o'clock.
SOUTH SUBURBAN GAS COMPANY. Albion Tavern, Aug. 11. Three o'clock.
TOTTENHAM AND EDMONTON GAS COMPANY. Offices. Aug. 19. 2.30 o'clock.
WEST HAM GAS COMPANY. Liverpool Street Hotel. Aug. 10. 12.30 o'clock.

Stocks and Shares.

NEWCASTLE AND GATESHEAD GAS COMPANY. July 31.
WHITBY GAS COMPANY. Aug. 14.

TENDERS FOR

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EAST RETFORD GAS DEPARTMENT. Tenders by July 29.

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NOTES ON WATER SUPPLY.—By J. T. RODDA, Assoc.M.Inst.C.E., Assoc.M.Inst.Mech.E., Member of the British Association of Water-Works Engineers. *Price 5s.*

INTERNATIONAL ENGINEERING CONGRESS (GLASGOW, 1901)—THE PROCEEDINGS OF THE GAS SECTION. Edited by J. W. HELPS, M.Inst.C.E. *Price 5s.*

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WANTED, Experienced Erectors for Gas-Works Plant.
Apply, by letter, giving Particulars of where last Employed, and particular branch. None but all-round, Steady, and Reliable men need apply. Biggs, Wall, and Co., 13, Cross Street, Finsbury Pavement, London.

WANTED, at once, in a Lancashire town, Three leading working STOKERS. Experience in charging Inclined Retorts essential. Good Wages offered to efficient men.
Apply, by letter, not later than Saturday, the 29th of July, to No. 4435, care of Mr. King, 11, Bolt Court, Fleet Street, E.C.

WANTED, by a Gas Company near London, a JUNIOR CLERK for Works Office, to record workmen's times and to analyze same for Wages Account, and to perform such other duties as the Manager may direct. Wages 27s. per week.
Applications, with Reference, to be addressed to No. 4439, care of Mr. King, 11, Bolt Court, Fleet Street, E.C.

ORIENTAL GAS COMPANY, LIMITED.
WORKS Foreman required for Calcutta. Age about 30. Unmarried. Must have a knowledge of Gas Manufacture, including Regenerative Firing and Sulphate of Ammonia.
Further details may be obtained from the Secretary, Oriental Gas Company, Limited, Finsbury House, Blomfield Street, London, E.C.

WANTED, by a Gas-Works in the South-West of England, a competent Man for a few months to undertake the Investigation of the Mains and Services in two districts for the detection of Leakages. Must thoroughly understand the best methods of detecting leakages.
Apply, stating Age, Wages, and Experience, with References, to No. 4436, care of Mr. King, 11, Bolt Court, Fleet Street, E.C.

A FIRST-CLASS opening is offered as REPRESENTATIVE of a large Firm in the Gas Coal trade, more particularly to take charge of the Continental branch of the business. To a really Energetic Man with Good Connection arrangements might be made for an eventual permanent share in any business introduced.
Address, in the strictest confidence, No. 4432, care of Mr. King, 11, Bolt Court, Fleet Street, E.C.

THE Millom Urban District Council require a competent MANAGER of their Gas and Water Works. Must be able to keep the Books and Accounts of these Departments. Junior Clerk provided. To commence duty on the 1st of October next.
Salary £150 per annum.
Applications (in writing only) to state Age, Qualifications, and Experience, and to be accompanied by *copies* (not originals) of not more than Three Testimonials, to be sent to me by the 1st of August prox.
Canvassing will disqualify.
About 2200 Tons of Coal are carbonized annually. Regenerator Retorts are in operation. Sulphate of Ammonia to be made. Water supply from reservoir by gravitation.
W. T. Lawrence,
Clerk to the Council.
Millom, July 19, 1905.

FOR Sale, a Solid-lead Saturator (made by Taylor, Bolton). Capacity, 3 to 4 Tons of Salt per twenty-four hours. Length 5 ft. 3 in., breadth 4 ft. 6 in., depth 3 ft., body 1¼ in., bottom 1½ in. thick lead, with heavy timber Frame and Cradle. Fitted with well for Sulphate Lifter. Equal to new. Replaced by larger size.
For Prices and further Particulars, apply to R. and J. Dempster, Limited, Manchester.

TO BE SOLD, Four Lengths of New Steel Hydraulic Main, D-shaped, 18 in. by 18 in. by 9 ft. 6 in. long each, tops perforated for 6 Dip Pipes. Also 6-inch Ascension, Arch, and Dip Pipes to suit, ready for delivery.
Write the Wright Gas Plant Manufacturing Company, Limited, 181, Queen Victoria Street, London, E.C.

GAS PLANT for Sale—I can always offer NEW and SECOND-HAND GAS APPARATUS, including Retorts and Fittings, Condensers, Exhausters, Scrubbers, Washers, Purifiers, Gasholders, Tanks, Valves, Connections, &c. Also a few COMPLETE WORKS. Compare Prices and Particulars before ordering elsewhere.
J. F. Blakeley, Gas Engineer, Thornhill, Dewsbury.

BOROUGH OF EAST RETFORD.
THE Gas Committee of the above Cor- poration are open to receive TENDERS for the supply of 6500 Tons of Screened, Unscreened GAS COAL or NUTS, to be delivered at the Sidings of the G.N. or the G.C. Railways, during the Year ending July 31, 1906.
Forms of Tender and further Particulars may be had on application to the undersigned.
Tenders to be sent in, addressed to the Chairman of the Gas Committee, on or before July 29, 1905.
J. B. Fenwick,
Engineer and Manager.
Gas and Water Offices,
July 17, 1905.

THE GASLIGHT AND COKE COMPANY.
NOTICE is Hereby Given, that a HALF-YEARLY ORDINARY GENERAL MEETING of the Proprietors of this Company will be held at this Office on Friday, the 4th day of August next, at Twelve o'clock (noon) precisely, to transact the usual Business, including the declaration of a Dividend for the Half Year ending on the 30th day of June last.
Notice is Hereby also Given, that, at such Meeting, the Directors will apply to the Proprietors for authority to dispose of such further portions of the Company's property as are not now required for the purpose of their undertaking.
By order,
H. Rayner,
Secretary.
Chief Office, Horseferry Road,
Westminster, S.W., July 18, 1905.

TOTTENHAM AND EDMONTON GASLIGHT AND COKE COMPANY.
NOTICE is Hereby Given, that the ANNUAL ORDINARY GENERAL MEETING of the Proprietors of this Company will be held at the Company's Chief Offices, 639, High Road, Tottenham, on Saturday, the 19th day of August next, at Half-past Two o'clock in the afternoon precisely, to receive the Report of the Directors and Statement of Accounts for the Half-Year ended the 30th of June, 1905; to declare a Dividend for the same period; to elect Two Directors and an Auditor for the ensuing year; and for the transaction of General Business.
The TRANSFER BOOKS WILL BE CLOSED for the CONSOLIDATED STOCKS from the 5th to the 21st day of August, both days inclusive.
By order of the Board,
James Randall,
Secretary.
Chief Offices: 639, High Road,
Tottenham, July 21, 1905.

WEST HAM GAS COMPANY.
NOTICE is Hereby Given, that the ORDINARY HALF-YEARLY MEETING of the Proprietors of this Company will be held at the Abercorn Rooms, Liverpool Street Hotel, E.C. (Bishopsgate Street entrance), on Thursday, the 10th day of August, 1905, at 12.30 p.m. o'clock precisely, to receive the Report of the Directors and Statement of Accounts for the Half-Year ending the 30th of June, 1905, to declare a Dividend, and for other general business,
AND
Notice is Hereby further Given, that immediately after the conclusion of the ordinary business of the Company, an EXTRAORDINARY MEETING of the Proprietors will be held in order to consider and, if approved, to pass a Resolution to the following effect, viz.—
"That the sum of £100,000 Consolidated Ordinary Stock, and the sum of £35,000 Perpetual 4 per Cent. Debenture Stock be and the same are hereby respectively created in accordance with the provisions of the West Ham Gas Act, 1902; and that the Directors be and they are hereby authorized to issue and allot the said Consolidated Ordinary and Debenture Stocks at such times and at such price or prices, and either by Tender or Auction as they may deem fit, and also out of any premiums received on such allotment to pay brokerage, commissions, and such other expenses as they may consider reasonable and proper."
The TRANSFER BOOKS of the Company, so far as they relate to Consolidated Ordinary and Preference Stocks, WILL BE CLOSED from the 28th of July inst. to the 10th of August next, both days inclusive.
By order of the Board,
A. G. Snelgrove,
Secretary.
Gas-Works, Stratford, E.,
July 19, 1905.

SOUTH SUBURBAN GAS COMPANY.

NOTICE is Hereby Given, that the ORDINARY HALF-YEARLY GENERAL MEETING of the Proprietors of this Company will be held at the Albion Tavern, Aldersgate Street, London, E.C., on Friday, the 11th day of August, 1905, at Three o'clock in the afternoon precisely, to receive the Report of the Directors and Statement of Accounts for the Half Year ended June 30 last, to declare a Dividend for the same period, and for General Purposes.

The TRANSFER BOOKS WILL BE CLOSED from the 28th day of July until after the Meeting.

By order of the Board,
CHARLES M. OHREN,
Secretary.

Offices and Works:
Lower Sydenham, S.E.,
July 24, 1905.

BRENTFORD GAS COMPANY.

NOTICE is Hereby Given, that a HALF-YEARLY ORDINARY GENERAL MEETING of the Proprietors will be held at the Charing Cross Hotel, London, on Friday, the 4th of August next, at Half-past Two o'clock precisely, to transact the usual Business, including the declaration of a Dividend for the Half-Year ending the 30th day of June last.

By order,
WILLIAM MANN,
Secretary.

Office, Brentford,
July 19, 1905.

EUROPEAN GAS COMPANY, LIMITED.

SHARE WARRANTS TO BEARER.

NOTICE is Hereby Given, that, in accordance with a Resolution passed at the Annual General Meeting of Shareholders, held on the 18th inst., a DIVIDEND and BONUS of Fourteen Shillings per Share will be payable on and after the 1st prox. on the above Shares, subject, however, to a deduction of 1s. 1d. per Share for French Stamp and Transfer Duty.

Payment will be made at the "Union of London and Smith's Bank, Ltd.," Princes Street, London, E.C., after serial Coupon No. 61 has been left three clear days for Examination.

W. WILLIAMS,
Secretary and General Manager.

July 18, 1905.

NEWCASTLE-UPON-TYNE AND GATESHEAD GAS COMPANY.

SALE OF £60,000 ORDINARY STOCK.

THE Directors offer for Sale by Tender £60,000 ORDINARY STOCK, to be issued under the provisions of the Newcastle-upon-Tyne and Gateshead Gas Act, 1901. Applications receivable up to Ten a.m. on the 31st of July, 1905.

When gas is charged at the present rate of 2s. per 1000 cubic feet, the Authorized Dividend is £4 12s. 6d. per cent.

Any amount of Stock, being not less than £5, or a multiple thereof, may be applied for. A deposit of 5 per cent. on the nominal amount of Stock applied for must accompany each Tender, and the balance be paid on or before the 30th of September, 1905. Interest at the rate of 4½ per cent. per annum will be allowed upon prepayments.

Minimum Price, £105 per cent.

The Company's profit for the year 1904 was £113,354; and after paying all interest and full statutory dividends, there was left a surplus profit of £21,530.

The gas sold in 1904 was 2813 Million Cubic Feet; and the number of Consumers 71,629—being an increase of 83 Millions and 8301 respectively over the previous year.

Prospectuses and Forms of Tender will be sent on application to the undersigned.

THOS. WADDOM,
Secretary.

Newcastle-upon-Tyne,
July 11, 1905.

WHITBY GAS COMPANY.

SALE BY TENDER OF 300 NEW ORDINARY SHARES.

NOTICE is Hereby Given, that it is the intention of the Directors of the Whitby Gas Company to SELL by TENDER, to be received at the Company's Office, Baxtergate, Whitby, not later than the 14th day of August, 1905,

THREE HUNDRED NEW ORDINARY SHARES of Ten Pounds each.

The Shares now for sale constitute a first issue of Additional Capital, which will be issued in accordance with the provisions of the Whitby Gas Act, 1904.

Any number of shares (not exceeding ten in each single lot) may be applied for. The Shares will be allotted to the highest Tenderers, at and above the reserve price.

Particulars and Conditions, with Forms of Tender, can be obtained from the undersigned.

WM. M. GALLEWAY,
Secretary.

Gas Office, Whitby, July 7, 1905.

ISSUES BY AUCTION OF GAS AND WATER STOCKS AND SHARES.

MR. ALFRED RICHARDS begs to notify that his ISSUES by AUCTION under PARLIAMENTARY POWERS of STOCKS and SHARES in LONDON, SUBURBAN, and PROVINCIAL GAS and WATER COMPANIES take place PERIODICALLY at the Mart, TOKENHOUSE YARD, E.C.

Terms for Issuing such Capital, and also for including Gas and Water Stocks and Shares belonging to Private Owners in these Periodical Sales, can be obtained on application at MR. ALFRED RICHARDS' OFFICES, 18, FINSBURY CIRCUS, E.C.

HORNSEY GAS COMPANY.

NOTICE is Hereby Given, that the ORDINARY HALF-YEARLY GENERAL MEETING of the Proprietors of this Company will be held at the Offices of the Company, No. 63, Chancery Lane, in the County of London, on Friday, the 4th day of August, 1905, at Half-past Three o'clock in the Afternoon precisely, to receive the Report of the Directors, and the Accounts for the Half-Year ended the 30th of June last; to declare Dividends; and to transact the Business of an Ordinary General Meeting.

The TRANSFER BOOKS WILL BE CLOSED from the 21st of July to the 4th of August, 1905, both days inclusive.

By order of the Board,
WILLIAM E. ROBERTS,
Secretary.

Offices: 63, Chancery Lane,
London, W.C., July 19, 1905.

Re H. GREENE & SONS, LTD. IN LIQUIDATION.

TO GAS ENGINEERS, MANUFACTURERS, IRONMONGERS, &c.

WEATHERALL & GREEN will Sell by AUCTION, at the Surrey Engineering Works, Blackfriars Road, on Wednesday, August 2, and following day, at One o'clock precisely, in lots, the whole of the valuable Modern Plant and Stock of the above well-known firm of Gas Engineers, comprising a large quantity of Brass, Copper, and other Gas-Brackets, Pendants, and Standards; Incandescent and other Burners and Mantles; Brass Cocks, Elbows, Bends, Unions, and other Fittings; Street Lamps and Lanterns, and Parts; a great variety of fancy and plain glass Shades and Globes; Gas Heating Stoves; Illumination Devices; a quantity of Sheet Lead, Lead and Compo. Piping, Iron Barrel and Bar Iron, Sheet Copper, Tin Plates, and Scrap Metal; also the Expensive Plant and Machinery, including a 4-Horse Power Smithfield Gas-Engine, by T. Green & Son; a Punching and Cutting Machine; Large Screw-Cutting and Turning Lathe; a smaller ditto, by Selig, Sonnenthal, & Co.; Drilling Machine, by J. Cohen & Co.; Shafting, Belting, Grindstone, Planing Machine, Circular Saw, Polishing Machine; a quantity of Tools and Benches; Office Furniture, Fixtures, and Fittings; 3 Safes. Brougham by Barker; Trolleys and Trucks; and a large variety of useful effects lotted to suit both private purchasers and the trade.

May be viewed day preceding Sale.

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Manufacture and keep in Stock at their Works (also large Stock in London)

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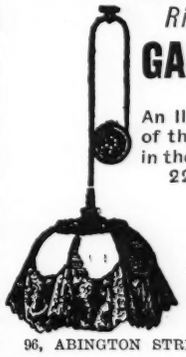

An Illustrated Description of this Pendant appeared in the "Journal" for Nov. 22, 1904 (page 599).

Write for full Particulars to the
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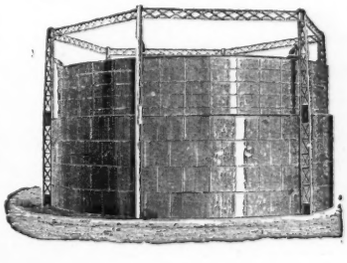

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For Particulars, Price, &c., apply to Mr. EDWARD PRICE, "Langley," Wyke Avenue, WORTHING.

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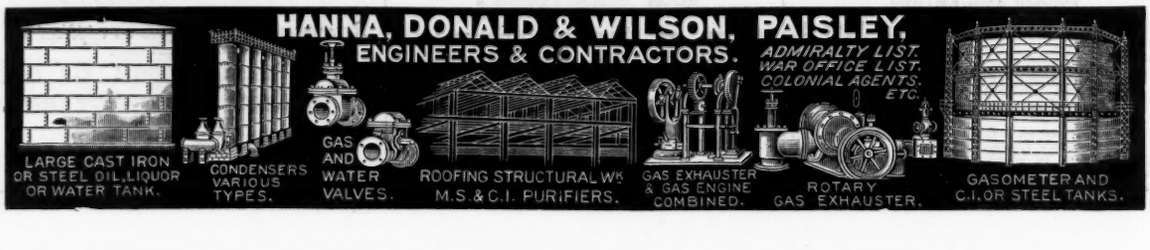
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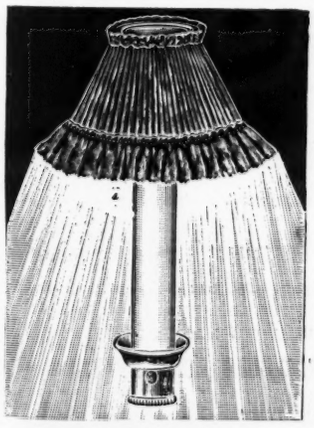

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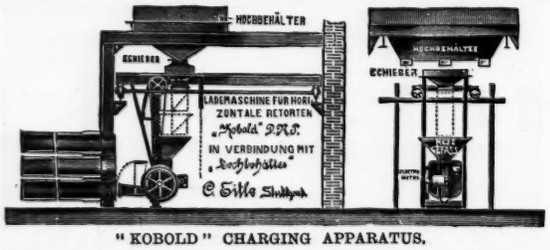
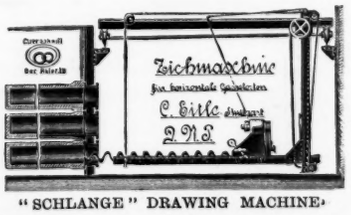


"KOBOLD" CHARGING APPARATUS.



"SCHLANGE" DRAWING MACHINE.

ADVANTAGES OF THE "KOBOLD" CHARGING APPARATUS.

1.—The simplest of all existing Charging Machines, as in charging there is only ONE shaft working.
2.—Almost indestructible in construction, as there are no combustible parts exposed to the heat of the Retorts.
3.—Uniform bed of coal of any desired height in the retort, and consequently any desired weight of charge may be inserted.
4.—Greater yield of gas in comparison with all other types, owing to the coal being deposited in the retort most advantageously.
5.—Least inrush of cold air owing to the close fit of the charging mouthpiece with the retort mouthpiece, with consequently practically no cooling of the retort, the least outrush of flame and smoke, and therefore smallest loss of gas.
6.—Smallest consumption of power.
7.—Most rapid working, as the complete charging of a retort requires only two pulls of a lever.
8.—May be set at any position in regard to height by either manual or motor power.
9.—Lowest cost to purchase; paying interest and redemption in about three years.

ADVANTAGES OF THE "SCHLANGE" DRAWING MACHINE.

1.—The simplest and best drawing machine in the world for horizontal retorts.
2.—Least time required to draw a retort (10-15 seconds).
3.—Most careful treatment of the lumps of coke, as well as the retort.
4.—Smallest consumption of power.
5.—Lowest cost to purchase.
6.—Most substantial construction, and consequently very low maintenance charges.
7.—Rapid and cheap working, consequently pays interest and redemption in a few years.

HISLOP'S PATENT SYSTEM OF BOILER FIRING.

20 °/₀ Saving in Fuel.
20 °/₀ more Water Evaporated per hour.
Steady Steam Pressure.
Fuel Employed—Coal or Coke.

Perfect Combustion—17 to 18 °/₀ CO_2 in Waste Gases.
Producer Cleaned once in 24 to 48 hours.
Applicable to all Boilers.

INEXPENSIVE. DURABLE. SIMPLE.

DESIGNS AND ESTIMATES FROM

R. & G. HISLOP, 13, ST. JAMES PLACE, PAISLEY.

LONDON—87, VICTORIA STREET, S.W.

Important Announcement

The Wholesale Fittings Co., Ltd.,

30, COMMERCIAL STREET, LONDON, E.

The Wholesale Fittings Co., Ltd., have acquired the Extensive Business Connections of The Wholesale Fittings Co., 80, Commercial Road, London, E.
The Perfect Mantle Co., 28, Minories, London, E.C.
The Crown Incandescent Light Co., 112, Newington Causeway, London, S.E.

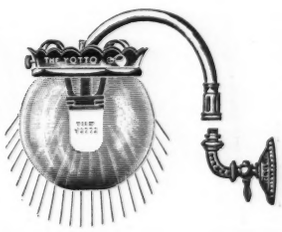
And are now the **Sole Proprietors** of the Celebrated **Bonbac, Coninco, Natco, Yotto, Permco, Kohab, Crown,** and **Cilco Mantles;** together with those well-known brands of Incandescent Chimneys—**The Favourite, The Marvel,** and **Silchrome French Hard Glass** (Trade Marks: "Defies-Candle" and "Silchrome").

INVENTORS AND PATENTEES OF

THE "JUAL" ARC LAMP AND THE "YOTTO" INVERTED BURNERS.

Wholesale Agents for "The Wolf-Light," and "The Star" Inverted Incandescent Specialities.

All Orders executed same day as received. Largest Stocks of all kinds of Incandescent Goods in the Kingdom.



"THE YOTTO."
Send for Particulars.

Note our New Address—

30, COMMERCIAL STREET, LONDON, E.

Telephone Nos.: *2543 LONDON WALL.* *1192 LONDON WALL.*
OLDEST HOUSE IN THE TRADE. ESTABLISHED 1895.
Telegraphic Address: *"CALOTTES, LONDON."*

COAL TAR PRODUCTS.

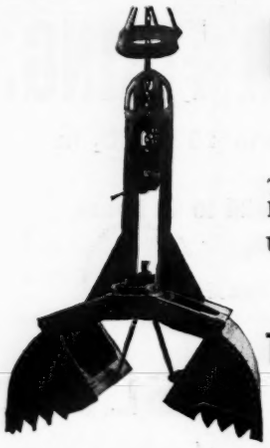
Benzol, Toluol, Solvent Naphtha, Creosote Oils, Grease Oils, Carbolic Acid, Crude Creosote Salts, Granulated (Crude) Naphthalene, Sublimed Naphthalene, Anthracene, Refined Tar, Pitch, also Sulphate of Ammonia.

For Prices apply to the **SOUTH METROPOLITAN GAS COMPANY,**

Works: ORDNANCE WHARF, EAST GREENWICH, LONDON, S.E.

709, OLD KENT ROAD, LONDON, S.E.

Telegraphic Address: "METROGAS, LONDON."



HONE'S PATENT GRABS

Automatic, Efficient, & Economical.

APPLICABLE TO ANY ORDINARY SINGLE CHAIN CRANE.

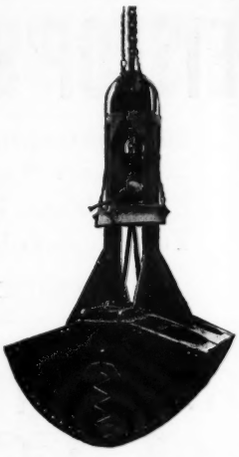
These Grabs are unequalled for handling Coal, Coke, Ballast, Sand, Macadam, Ores, &c., effecting in all cases very substantial savings.

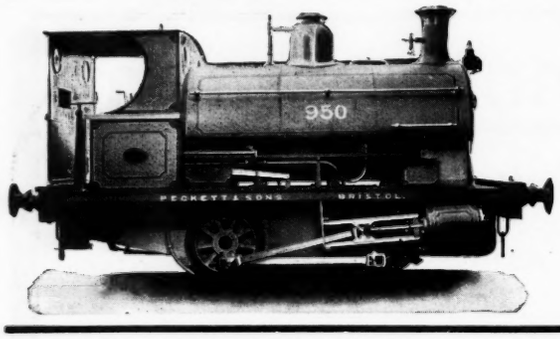
Used by all the Principal Gas Companies, Colliery Owners, Coal Merchants, Engineers, Contractors, &c., at Home and Abroad.

Applications for Prices and Particulars are invited by the Sole Manufacturer—

THE THAMES IRON WORKS, SHIPBUILDING, and ENGINEERING COMPANY, LTD.,

CANNING TOWN, LONDON, E.





LOCOMOTIVES

LOCOMOTIVES of all Sizes and Gauges specially constructed for Main and Branch Lines, Contractors, Docks, Gas-Works, Collieries, Iron-Works, Brick and Cement Works, &c. Locomotives of various Sizes always in Stock, ready for immediate delivery.

Photographs, Specifications, and Prices on Application.

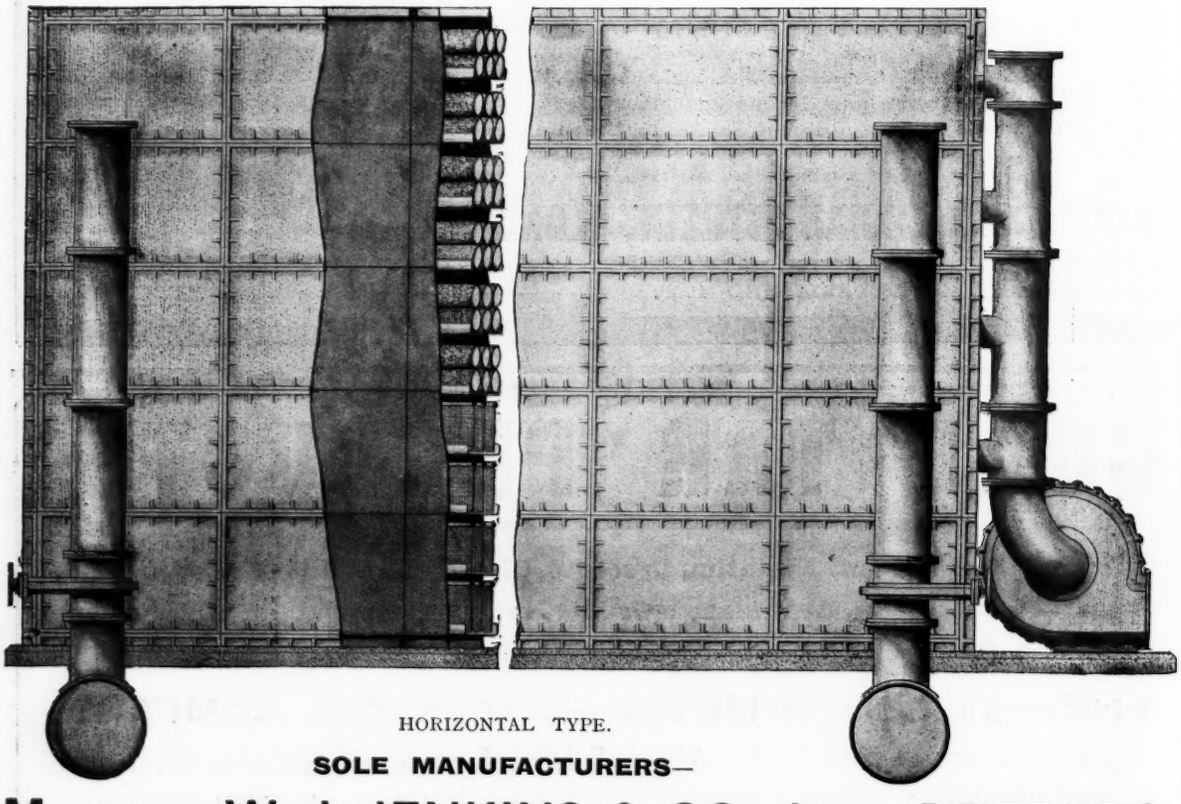
PECKETT & SONS, Atlas Locomotive Works, **BRISTOL.**

Telegraphic Address: "PECKETT, BRISTOL."

BROWNE & CHANDLER'S PATENT

Vaporizing Condensers.

In these Air Condensers a greatly increased efficiency is secured by Internal Evaporation of a comparatively trifling quantity of water, with or without Fan draught.



HORIZONTAL TYPE.

SOLE MANUFACTURERS—

MESSRS. W. J. JENKINS & CO., LTD., RETFORD.

EVERED & CO., LTD.,

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SURREY WORKS, SMETHWICK.
BARNET WORKS, BIRMINGHAM.

Brass Gas-Fittings Manufactory—SURREY WORKS, SMETHWICK.

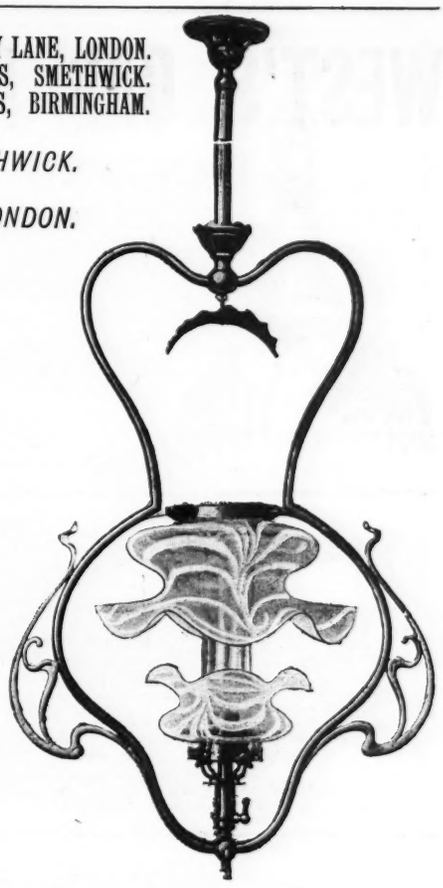
Wrought-Iron Gas-Fittings Manufactory—DRURY LANE, LONDON.

8869.

ANTIQUE FITTINGS

FOR

Ordinary and Incandescent Gas Burners.



8479—Length, 42-in. overall. ⅜-in. Rod. ⅜-in. Arms. Including 10-inch Crystal and White Enamelled Shade and Eye Screen.

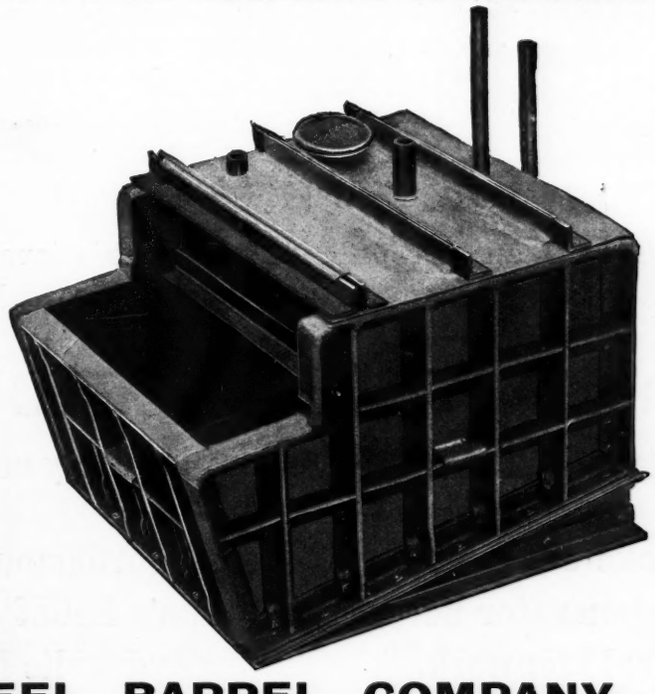
SHOREDITCH DEPÔT—

143, HIGH STREET.

STANDFAST'S PATENT SULPHATE OF AMMONIA SATURATOR

ELECTRICALLY WELDED!

Prices on application.



ALSO

STEEL BARRELS and DRUMS

FOR

Benzol, Tar, Creosote, Gasolene, Petrol, &c.

ALL JOINTS ELECTRICALLY WELDED.

SOLE MAKERS:

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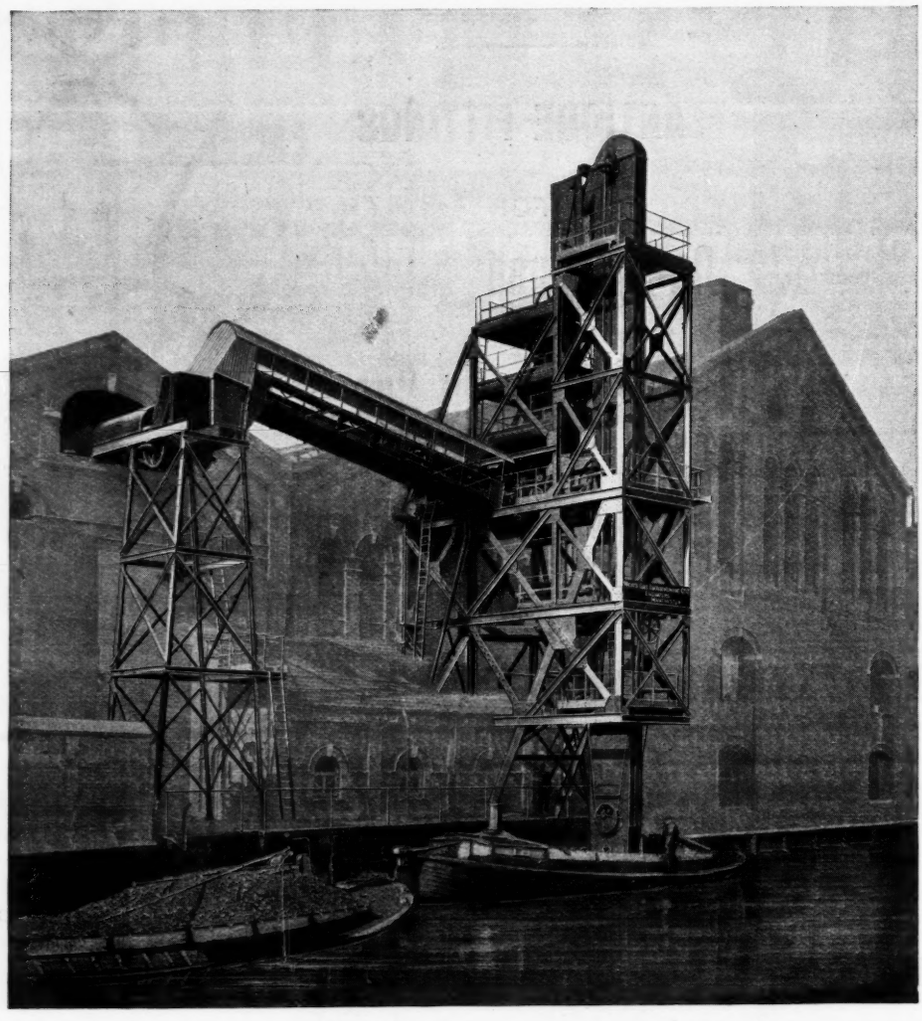
Contractors to His Majesty's Government, Government of India, British and Foreign Railways, &c.

WEST'S GAS IMPROVEMENT CO., LTD.,

GAS AND GENERAL ENGINEERS.



PHOTOGRAPH SHOWING

West's Coal Handling Plant for unloading Barges, Elevating, Breaking, Automatic Weighing, Conveying, and Storing the Coal in Stores.

STOKING MACHINERY SPECIALISTS

Over 140 Installations of West's Stoking Machinery now at work.

West's Patent Coke-Conveyors.
,, ,, Regenerator Settings.
General Structural Ironwork.

The Bournemouth Arch-Pipe.
Belton's Relief Apparatus for Hydraulic Mains.

ADDRESS—ALBION IRONWORKS, MILES PLATTING, MANCHESTER.

Telegrams: "STOKER, MANCHESTER" **Telephone Nos. 1339 & 5520.**

THE LARGEST GASHOLDER -IN THE- WORLD.

GASHOLDERS -OF ALL- SIZES AND STYLES.

ORIGINAL MAKERS OF SPIRAL GUIDED ..... HOLDERS.

Gasholder WITH LARGEST METAL TANK IN THE WORLD.

GAS PLANT OF EVERY DESCRIPTION. ROOFS, TANKS, STRUCTURAL STEEL WORK, BOILERS, &c.

CLAYTON SON & Co Ld LEEDS.

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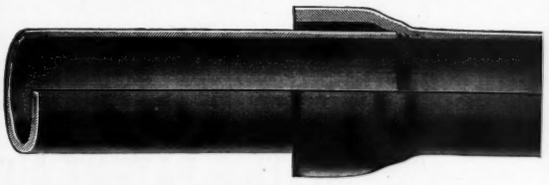


WELDLESS STEEL SPIGOT AND FAUCET PIPES

In any Length up to 40 feet for GAS & WATER MAINS.

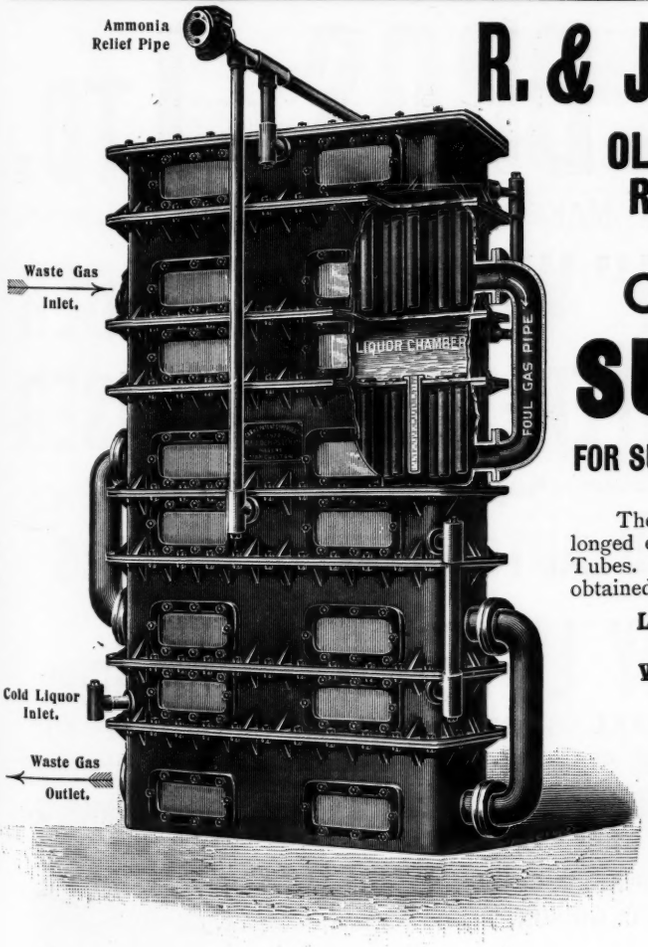
A PERFECT SUBSTITUTE FOR CAST-IRON MAINS.

— THE —

BRITISH MANNESMANN TUBE Co.,

— LIMITED, —

110, CANNON STREET, LONDON, E.C.



R. & J. DEMPSTER, LTD., OLDHAM ROAD, MANCHESTER.

CARR'S PATENT

SUPERHEATER

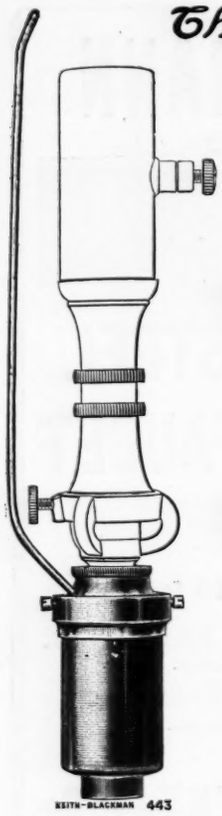
FOR SULPHATE OF AMMONIA OR OTHER PLANTS.

The rectangular shape of this Superheater effects a prolonged contact of the waste heat with the depending Liquor Tubes. In Superheaters at work the following efficiency is obtained:—

Liquor Inlet to Superheater ..	64° F.
„ Inlet to Still	191° F.
Waste Gas Inlet to Superheater ..	205° F.
„ „ Outlet from „ ..	75° F.

STEAM AND FUEL ARE SAVED;
THE CAPACITY OF THE PLANT IS INCREASED;
THE CHEAPEST UNREFINED ACID CAN BE USED;
AND LESS CONDENSING POWER IS REQUIRED.

PRICES AND PARTICULARS ON APPLICATION.



Automatic Bye-Pass.

The KEITH LIGHT.

INTENSIFIED INCANDESCENT GAS.

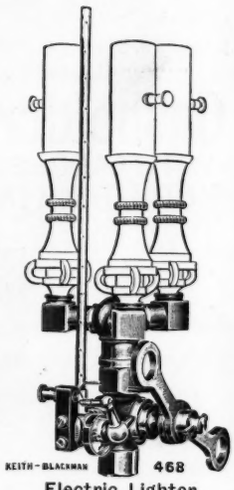
2000 INSTALLATIONS NOW IN USE.

KEITH'S PATENT AUTOMATIC BYE-PASS

places Gas on an equal footing with Electricity as far as Lighting and Extinguishing are concerned. *For full Particulars see 1904 Catalogue.*

KEITH'S PATENT ELECTRIC LIGHTERS

are made for single burners or clusters of burners. Simple in construction, certain in action. Save in bye-pass gas their own cost in six months. Suitable for both High and Low Pressure Gas. Particularly approved of by Insurance Companies.



Electric Lighter for Cluster.

Patentees and Manufacturers:

JAMES KEITH & BLACKMAN CO., LTD., 27, FARRINGDON AVENUE, LONDON, E.C.

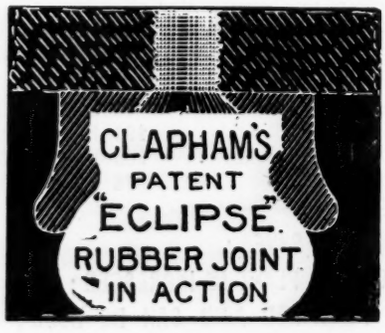
CLAPHAM BROS., LTD.

ESTABLISHED OVER 60 YEARS.] SOLE MAKERS OF **KEIGHLEY.**

Laycock & Clapham's Patent **"ECLIPSE" WASHER-SCRUBBER**

Clapham's Patent **"ECLIPSE" WATER-TUBE CONDENSER**

Clapham's New Century Cover, with Patent



RAPID AUTOMATIC FASTENERS

FOR

DRY LUTE PURIFIERS.

MAKERS OF ALL IRONWORK FOR

CARBONIZING PLANTS, FOR INCLINED OR HORIZONTAL SYSTEMS. TAR EXTRACTORS, VALVES, MAINS, LAMP COLUMNS, TANKS, &c.

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Printed for WALTER KING by King, Sell, & Olding, Ltd.; and published by him at 11, BOLT COURT, FLEET STREET, in the CITY OF LONDON.—Tuesday, July 25, 1905.